

## 9.3.28 FUEL SPILL NO.28 (FS-28) GROUND WATER

### A. BACKGROUND

#### A.1 Site Description

The FS-28 plume was first discovered in 1993 beneath the leading edge of the CS-4 plume and was subsequently investigated as a separate groundwater plume. The investigations found EDB to be upwelling into the Coonamessett River in Falmouth in 1996. The primary contaminant of concern in the FS-28 plume is EDB.

The FS-28 plume is a component of the Southwestern Operable Unit (SWOU). The FS-28 plume extends from the Crane Wildlife Management Area north of Route 151, flows under the western portion of Coonamessett Pond, and terminates in the cranberry bogs surrounding the Coonamessett River (**Figure 9.3.28-1**). The highest concentrations of EDB in the FS-28 plume are found in the vicinity of the extraction well (EW-1), with concentrations decreasing to the north.

The concentrations in the northern part of the plume are relatively dilute; the highest concentration of EDB was 0.031 µg/l (the MMCL for EDB is 0.02µg/l). Periodic monitoring of wells in the northern part of the plume indicates that EDB concentrations are decreasing.

The portion of the plume south of Hatchville Road comes to a narrow point because groundwater in and around the plume flows toward the river. If left uncaptured, most of the plume will discharge to the river north of Thomas B. Landers Road. A small, dilute portion (approximately 0.30 percent of the total plume mass) is migrating in the subsurface downgradient of the current extraction system. This portion of the plume is expected to discharge farther downstream, but will be undetectable when it does reach the river.

The FS-28 source area has not been identified, and thus the plume cannot be traced back to a specific area on MMR. It is speculated that EDB entered the groundwater from fuel spills.

#### A.2 Initial Responses

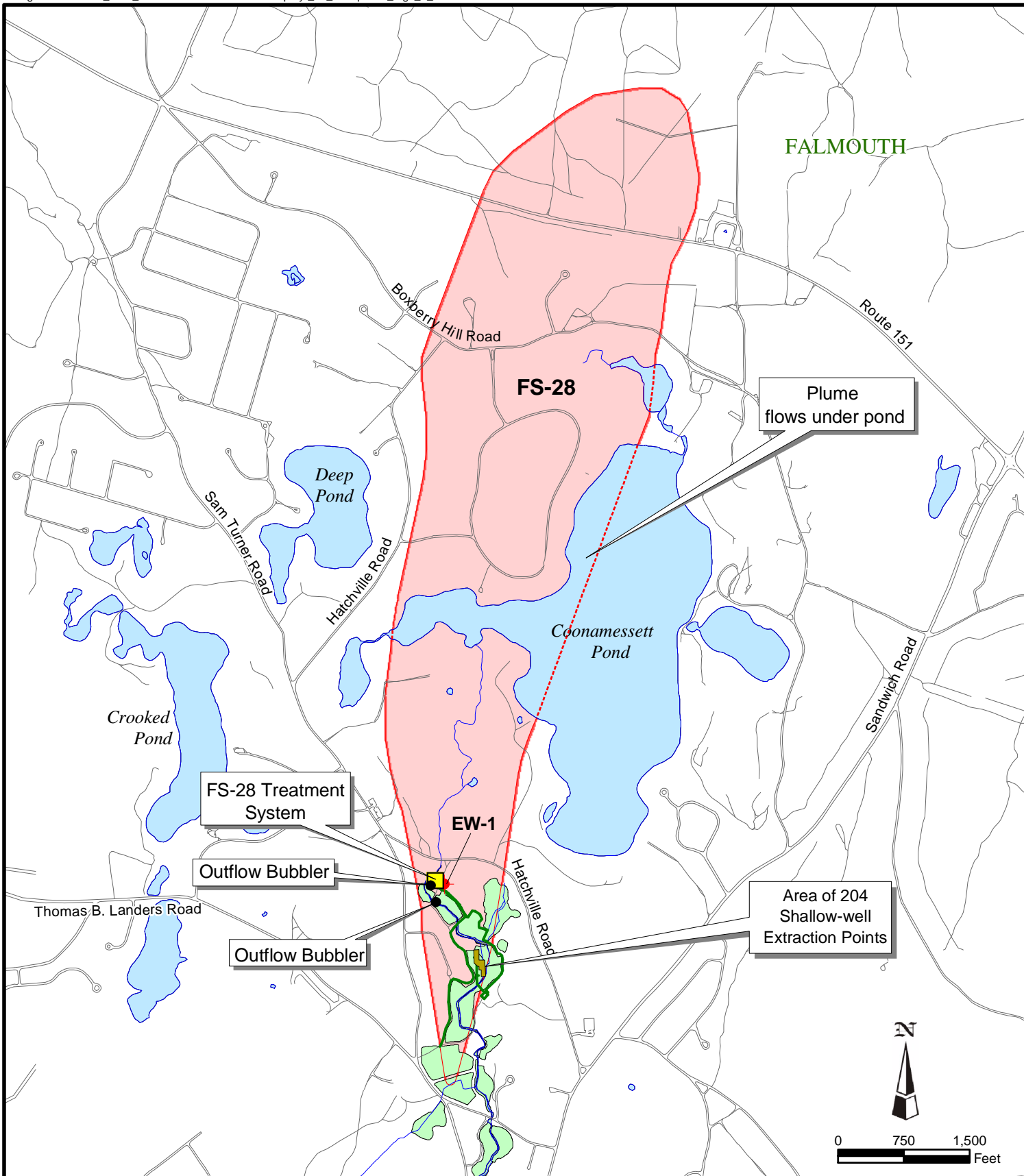
##### Non-CERCLA Actions

In 1996, AFCEE completed construction of a wellhead carbon filtration system for the Coonamessett Water Supply Well (CWSW) as a precaution, even though this well has never been affected by the FS-28 plume.

In 1997 and 1998, in an effort to protect public health and eliminate the threat of EDB in private wells near homes above and/or near the FS-28 plume, AFCEE installed town water mains and piping to 207 residents of Hatchville. Ten irrigation wells were also installed for cranberry growers along the river system to replace their previous use of surface water. Growers were compensated for their 1997 crop.

##### CERCLA Actions

AFCEE implemented an extraction and treatment system in 1997 under the CERCLA time-critical removal action process to capture the majority of the plume mass at Hatchville Road and to



### Legend

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|---|--|
| <span style="display: inline-block; width: 20px; height: 10px; background-color: red; border: 1px solid black;"></span> Plume Contour = Concentrations exceeding drinking water standards or Maximum Contaminant Level (MCL). Represents an exceedance of ethylene dibromide (1,2-dibromoethane)(EDB) (EDB MCL = 0.02 µg/L) | <span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; border: 1px solid black;"></span> Treatment Facility  |
|   | <span style="display: inline-block; width: 20px; border-bottom: 2px solid green;"></span> Treatment System Piping  |
|   | <span style="display: inline-block; width: 0; height: 0; border-left: 5px solid transparent; border-right: 5px solid transparent; border-bottom: 8px solid red;"></span> Extraction Well |
|   | <span style="display: inline-block; width: 5px; height: 5px; background-color: black; border-radius: 50%;"></span> Outflow Bubbler   |
|   | <span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span> Area of 204 Shallow-well Extraction Points                     |
|   | <span style="display: inline-block; width: 20px; height: 10px; background-color: lightgreen; border: 1px solid black;"></span> Bogs  |



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### Fuel Spill 28 (FS-28) Plume December 2002

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minimize upwelling into the Coonamessett River System. In April 1999, AFCEE implemented a non-time-critical removal action which added additional extraction capacity to the system in the form of shallow well points to eliminate the discharge of EDB to the Coonamessett River and neighboring cranberry bogs. Since May 1999, monthly surface water sampling at 27 locations in the Coonamessett River system has found no detectable concentrations of EDB. The decrease in EDB concentrations in the river is attributable to the removal actions to capture EDB-contaminated groundwater before it entered the river.

### **A.3 Basis for Taking Action**

The basis for taking action is detected concentrations of EDB and risk assessment results of the SWOU RI (AFCEE, 1999). The baseline cancer risk calculations in the SWOU RI indicated that unless remedial action is undertaken, future residential exposure to contaminated groundwater may present an excess lifetime cancer risk greater than the acceptable MADEP threshold of  $1 \times 10^{-5}$  and the acceptable USEPA range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ .

## **B. REMEDIAL ACTIONS**

This section presents the regulatory actions, remedial action objectives (RAOs), and remedy description for the FS-28 Plume.

### **B.1 Regulatory Actions**

A FS was completed in 2000 (AFCEE, 2000a). Four of seven alternatives were retained for alternatives analysis [i.e., (1) No remedial action with long-term monitoring; (3) Continued treatment system operations (EW-1, the CWSW wellhead protection system, and the shallow well-point extraction system); (6) Continued remedial operations with the addition of a new ETR system in the area of Coonamessett Circle to reduce aquifer restoration time and prevent contaminants in the northwestern portion of the plume from migrating under the pond; and (7) Continued remedial operations with the addition of a ETD system in the Souza Conservation Area (immediately south of the western arm of Coonamessett Pond) to reduce aquifer restoration time. A Proposed Plan was released to the public in February 2000 (AFCEE, 2000b) to solicit comments on the preferred alternative (Alternative 7). The remedy selected and documented in the ROD (AFCEE, 2000) was Alternative 3 (i.e., continue treatment system operations).

### **B.2 Remedial Action Objectives**

The RAOs presented in the ROD (AFCEE, 2000c) are the following:

- Prevent or reduce residential exposure to EDB exceeding 0.02 µg/l in the groundwater, which is the MMCL for EDB.
- Prevent worker contact and child and wader contact with the Coonamessett River containing unacceptable concentrations of EDB.
- Prevent or reduce ingestion of fish exposed to Coonamessett River water containing unacceptable concentrations of EDB
- Restore the aquifer to its beneficial uses within a reasonable timeframe.

### B.3 Remedy Description

The selected remedy in the ROD (AFCEE, 2000c) includes the following components:

- Continued operation of the existing FS-28 ETD system including the 204 shallow well-point extraction system and the CWSW wellhead treatment system. Extracted water would be treated with GAC. Contaminants would be destroyed during carbon reactivation. Treated water could be used, if necessary for cranberry operations in the upper bogs. Berms and vinyl sheet piles would separate cranberry bogs from the river.
- Continue to supply uncontaminated water to the agricultural users on the Coonamessett River.
- Institutional controls mitigate exposure to humans from EDB-contaminated groundwater. In 1999, the Falmouth Board of Health adopted water well regulations to minimize the risk of exposure to groundwater contamination.
- Engineering controls are in place to mitigate exposure to humans from EDB-contaminated groundwater. Residents potentially impacted by the plume are connected to a public water supply.
- Monitoring of the plume and performance monitoring of the treatment systems. Ecological sampling would also be conducted as part of this alternative. The focus of ecological sampling is to measure the impact that treatment systems (not the plume) have on the environment.

Under Alternative 3, the northern part of the plume (above Coonamessett Pond) is expected to be restored in approximately 12 years, and the entire plume (99.7 percent) will be captured in approximately 18 years.

### B.4 Remedy Implementation

The existing ETD system has been in place since September 1997 with modifications in April 1999. The system has treated 1,771.90 million gallons and has removed 9.5 lbs of EDB (based on data through September 2002).

## C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The following activities were conducted/observed since the last review.

- Final FS: Completed in January, 2000 (AFCEE, 2000a)
- Final ROD: Completed in October, 2000 (AFCEE, 2000c)

## D. TECHNICAL ASSESSMENT

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA 2001). **Table D-1** summarizes the answers to the technical assessment questions.

**Question A: Is the remedy functioning as intended by the decision documents?**

Yes, the remedy is functioning as intended by the ROD. Institutional controls are in place to mitigate exposure pathways to humans.

**Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**Changes in Standards and To-Be Considered

There have been no changes in standards or TBC guidance.

Changes in Exposure Pathways

There have been no changes to exposure pathways and land use of the site that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for COCs.

Changes in Risk Assessment Methods:

There were no changes in risk assessment methodology.

Expected Progress Towards Meeting RAOS:

The system is making progress of completing the cleanup with the estimated timeframe of 18 years.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy?**

No.

<b>Table D-1: Technical Assessment Summary for the FS-28 Plume</b>		
<b>Question Item</b>	<b>Question</b>	<b>Response</b>
A	Is the removal action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the remedy?	No

**E. ISSUES**

For the review period, there are no issues for the FS-28 groundwater plume.

## F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Since there are no issues, there are no recommendations or follow-up actions. Treatment system monitoring, operations and maintenance should continue until cleanup goals are achieved.

## G. PROTECTIVENESS STATEMENT

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled by the treatment system and institutional/engineering controls.

All threats at the site have been addressed by the implementation of the remedy (i.e., removal of EDB from groundwater; continued supply of uncontaminated water to the agricultural users on the Coonamessett River; institutional controls via the Falmouth water well regulations; and connection of the majority of potentially impacted residences to the public water supply).

Long-term protectiveness of the remedial action will be verified by monitoring groundwater and Coonamessett Pond. Current monitoring data indicate that the remedy is functioning as required to achieve groundwater cleanup goals.

## H. REFERENCES

AFCEE, 2000c *Final Record of Decision for the Fuel Spill-28 and Fuel Spill-29 Plumes*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. October 2000

AFCEE, 2000b *Final Proposed Plan for the Fuel Spill-28 and Fuel Spill-29 Plumes in the Southwest Operable Unit*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. February 2000

AFCEE, 2000a *Final FS-28 and FS-29 Groundwater Feasibility Study*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. January 2000

AFCEE, 1999 *Final Southwest Operable Unit Remedial Investigation*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. May 1999

USEPA, 2001 *Comprehensive Five-Year Review Guidance*, EPA 540R-01-007, June, 2001.

### **9.3.29 FUEL SPILL NO.29 (FS-29) GROUND WATER**

#### **A. BACKGROUND**

##### **A.1 Site Description**

The FS-29 plume was discovered during investigation activities in 1998 as part of the SWOU RI. The FS-29 plume extends from the Crane Wildlife Management Area across Route 151 and approaching Route 28. The plume is defined primarily by EDB and carbon tetrachloride. **Figure 9.3.29** presents the FS-29 plume as of December 2002. The FS-29 plume is detached and its source area is unknown.

##### **A.2 Initial Responses**

###### Non-CERCLA Actions:

In 1999, the Falmouth Board of Health adopted water well regulations to minimize the risk of exposure to groundwater contamination. Furthermore, residents potentially impacted by the plume are connected to a public water supply.

##### **A.3 Basis for Taking Action**

The basis for taking action is detected concentrations of EDB and carbon tetrachloride greater than their respective MCLs and risk assessment results of the SWOU RI (AFCEE, 1999a). The baseline cancer risk calculations in the SWOU RI indicated that unless remedial action is undertaken, future residential exposure to contaminated groundwater may present an excess lifetime cancer risk greater than the acceptable MADEP threshold of  $1 \times 10^{-5}$  and the acceptable USEPA range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ .

#### **B. REMEDIAL ACTIONS**

This section presents the regulatory actions, remedial action objectives (RAOs), and remedy description for the FS-29 Plume.

##### **B.1 Regulatory Actions**

An FS was completed in 2000 (AFCEE, 2000a). Four of seven alternatives were retained for alternatives analysis : (1) No remedial action with long-term monitoring, (2) Institutional controls to prevent future residential exposure to FS-29 plume contaminants, (3) Construction of a groundwater ETI system using GAC, and (7) Construction of a groundwater ETI system using GAC to capture the central portion of the plume. A Proposed Plan was released to the public in February 2000 (AFCEE, 2000b) to solicit comments on the preferred alternative (Alternative 7). The selected remedy, however, was Alternative 3, because the alternative is expected to restore the aquifer in a shorter timeframe than Alternative 7. The selected remedy was documented in the Record of Decision for the Fuel Spill-28 and Fuel Spill-29 Plumes (AFCEE, 2000c).

## B.2 Remedial Action Objectives

The RAOs defined in the ROD (AFCEE, 2000c) are:

- Prevent or reduce residential exposure to EDB exceeding 0.02 µg/l in the groundwater, which is the MMCL for EDB. Prevent or reduce residential exposure to carbon tetrachloride exceeding 5 µg/l in the groundwater, which is the Federal MCL for carbon tetrachloride.
- Restore the aquifer to its beneficial uses within a reasonable timeframe.

## B.3 Remedy Description

The selected remedy for the FS-29 Plume is Alternative 3 which includes design, construction, and operation of an ETI system to hydraulically capture and treat plume contaminants. Because RI data was limited, the alternative also required additional sampling and analysis for plume delineation. The selected remedy as presented in the ROD consisted of extracting 600 gpm of groundwater through two extraction wells, processing the influent through greensand filters and GAC, and discharging the water into an infiltration trench. Groundwater modeling also indicated that the most upgradient portion of the FS-29 plume will be captured and treated by the system planned for the CS-21 plume. The estimated time to reach cleanup was eight years.

The alternative also included institutional controls to mitigate exposure to humans from contaminated groundwater. Institutional controls in place include connection of residents to the municipal water supply (Falmouth) and well installation regulations administered by the Falmouth Board of Health. For the portion of the plume underneath the Crane Wildlife Refuge, the Massachusetts water supply permitting process mitigates exposure of the public to contaminated groundwater.

AFCEE performed a pre-design data gap investigation in 2001 to support construction of the remedy. The pre-design data gap investigation in 2001 is documented in the FS-29 Plume Technical Memorandum (AFCEE, 2002). The FS-29 plume delineation has been better defined as a result of the analysis of data which is twice that was available for preparation of the RI/FS. Important plume characterization information include: most of the contaminant mass is located in the northeastern and central plume of the plume; the CS-21 and FS-29 plumes may not intersect, therefore the planned system for CS-21 may not capture the upgradient portion of the FS-29 plume; and groundwater modeling indicates that time to reach cleanup standards has increased to over 10 years.

The results of the pre-design data gap investigation in 2001 led to a reevaluation of alternatives in the FS-29 Plume Technical Memorandum (AFCEE, 2002). Alternative 7, which was the preferred alternative presented to the public in the Proposed Plan has some advantages over Alternative 3 (the selected alternative) including being more cost effective, and more expedient in mass removal from the most contaminated part of the plume, and avoiding construction in residential areas. However, because both alternatives employ the same treatment systems, AFCEE will move forward with Alternative 3 provided that periodic monitoring data collected in the following two years demonstrates that it is still appropriate to actively treat the westernmost portion of the FS-29 plume.

## **B.4 Remedy Implementation**

The ETI system is currently in the design and construct phase. Institutional and engineering controls are in place to mitigate exposure to humans from contaminated groundwater.

## **C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW**

The following activities were conducted/observed since the last review:

- Final FS: Completed in January, 2000 (AFCEE, 2000a)
- Final ROD: Completed in October, 2000 (AFCEE, 2000c)
- Technical Memorandum (pre-design data gap investigation and alternatives analysis): Completed in March, 2002 (AFCEE, 2002)

## **D. TECHNICAL ASSESSMENT**

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA 2001). **Table D-1** summarizes the technical assessment.

### **Question A: Is the remedy functioning as intended by the decision documents?**

Yes, the remedy design specifications will be constructed in accordance with requirements of the ROD and optimized based on pre-design information. Furthermore, institutional controls are in place to mitigate exposure to humans from contaminated groundwater.

### **Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**

#### Changes in Standards and To-Be Considered

There have been no changes in standards or TBC guidance.

#### Changes in Exposure Pathways

There have been no changes to exposure pathways and land use of the site that would affect the protectiveness of the remedy.

#### Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for COCs.

#### Changes in Risk Assessment Methods:

There were no changes in risk assessment methodology.

#### Expected Progress Towards Meeting RAOS:

The remedy is currently in the design phase. The implementation of the remedy is expected to restore the aquifer to beneficial purposes. The estimated timeframe for the selected remedy in the ROD to reach drinking water standards was 8 years (AFCEE, 2000c). However, groundwater modeling results based on more current and comprehensive data has increased the timeframe to achieve cleanup levels to more than 10 years (AFCEE, 2002). The increase in the timeframe to achieve cleanup does not affect the protectiveness of the remedy. Institutional controls and engineering controls have achieved the RAO of preventing exposure to humans from EDB and carbon tetrachloride in groundwater.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy?**

No.

<b>Table D-1: Technical Assessment Summary for the FS-29 Plume</b>		
<b>Question Item</b>	<b>Question</b>	<b>Response</b>
A	Is the removal action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the remedy?	No

**E. ISSUES**

For the review period, there are no issues for the FS-29 groundwater plume.

**F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

Since there are no issues, there are no recommendations or follow-up actions. The wellfield design process will continue into 2003 with construction and startup of treatment operations to be scheduled after the wellfield design is approved by the regulatory agencies.

**G. PROTECTIVENESS STATEMENT**

The remedy for the FS-29 plume is expected to be protective of human health and the environment once cleanup goals are achieved, and in the interim; exposure pathways that could result in unacceptable risks are being controlled by engineering and institutional controls. Furthermore, AFCEE has determined that there is not an immediate danger, which would require time-critical response for the FS-29 plume.

## H. REFERENCES

AFCEE, 2002 *Fuel Spill-29 Plume Technical Memorandum*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. October 2000

AFCEE, 2000c *Final Record of Decision for the Fuel Spill-28 and Fuel Spill-29 Plumes*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. October 2000

AFCEE, 2000b *Final Proposed Plan for the Fuel Spill-28 and Fuel Spill-29 Plumes in the Southwest Operable Unit*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. February 2000

AFCEE, 2000a *Final FS-28 and FS-29 Groundwater Feasibility Study*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. January 2000

AFCEE, 1999 *Final Southwest Operable Unit Remedial Investigation*. Prepared by Jacobs Engineering Group Inc., for the AFCEE/MMR IRP, Otis ANGB, MA. May 1999

USEPA, 2001 *Comprehensive Five-Year Review Guidance*, EPA 540R-01-007, June, 2001.

### 9.3.30 FIRE TRAINING AREA NO.2/ LANDFILL NO.2 (FTA-2/LF-2) SOURCE

#### A. BACKGROUND

##### A.1 Site Description

Area of Contamination (AOC) FTA-2/LF-2 is located approximately 250 feet west of the southern end of Runway No. 5, within the restricted zone known as the flightline security area. The AOC occupies approximately 11 acres, and includes a former fire-training area developed on top of a buried industrial/municipal landfill (**Figure 11**). Because AOC FTA-2 was located on top of AOC LF-2, they are considered one AOC.

Landfill operations at LF-2 began in approximately 1940 and were discontinued in 1944. Hazardous waste disposal at the landfill has not been documented. The Task 6 records search states that the landfill received domestic refuse that was burned and buried. At the time that LF-2 was in operation waste fuels, waste oils, and solvents were generally disposed of at the point of use; the records search does not document their disposal at LF-2. Test pits and field investigations at the site of LF-2 identified burned refuse and solid waste including bottles, glass, china, ash, cinders, metal scrap, and wood, concrete, and asphalt construction debris. The landfill was covered with fill material before the fire-training site was developed in 1948. During operation, FTA-2 may have received as much as 7,000 gal/yr of waste oil and fuel, AVGAS, JP-4 jet fuel, and lesser volumes of solvents that were ignited during fire-training exercises (AFCEE, 1997a).

Fire-training activities at FTA-2 began in an unlined depression on the southern part of the landfill. Sand, asphalt, and concrete rubble fill were apparently placed in the landfill swale before, during, and after fire-training activities. Placement of this material resulted in burial of the fire-training surface. FTA-2 was covered with additional soil following its abandonment in 1956 (AFCEE, 1997a).

##### A.2 Basis for Taking Action

**Site Investigation (SI):** A SI was completed in 1988 to assess the presence of contamination at the AOC. The SI consisted of a soil gas survey, excavation of 18 test pits, installation of two soil borings completed as monitoring wells, and soil and groundwater sampling. The soil gas survey detected trace concentrations of chlorinated solvents in seven samples. Test pits identified areas of burned refuse and stained soil.

**Remedial Investigation (RI):** The RI program was conducted in 1989 and 1990. This program included the installation of a soil boring completed as a monitoring well, excavation of four test pits, collection and analysis of seven surface and subsurface soil samples for TCL VOCs and SVOCs and Target Analyte List (TAL) inorganics, and analysis of groundwater samples from eight monitoring wells at or downgradient of the AOC for the same compounds.

**Supplemental RI:** The Supplemental RI provided additional information on contaminant concentrations in subsurface soil associated with the firefighter training site. This field program was performed in 1993, and included geophysical surveys to determine the extent of landfilled material, nine test pits within the landfill to characterize soil in both the landfill and fire-training area, and collection of subsurface soil samples from test pits and soil borings. Groundwater samples were also collected from monitoring wells associated with AOC FTA-2/LF-2.

In summary, available data indicated that the primary soil contaminants of AOC FTA-2/LF-2 are fuel-related VOCs and fuel and non-fuel-related SVOCs. Inorganics are secondary contaminants at the site. The highest concentrations of VOCs and SVOCs were observed at the FTA-2 burn pit which is interpreted to be the primary AOC-related source (AFCEE, 1998).

**Risk Evaluation Summary:** The RI report for AOC FTA-2/LF-2 included a human-health Preliminary Risk Assessment (PRA) to evaluate potential human-health risks associated with exposure to contaminated surface and subsurface soil under current and future site conditions and an ecological PRA to evaluate potential ecological risks associated with exposure to contaminated surface soil (zero to 2 feet bgs). Results of the PRA triggered the need for an evaluation of remedial alternatives (i.e. Feasibility Study). The contaminants of concern (COCs) identified at AOC FTA-2/LF-2 are ethylbenzene and total xylenes.

**Feasibility Study:** AOC FTA-2/LF-2 was included as part of the Six Areas of Contamination Source Area Feasibility Study completed in November 1997 (AFCEE, 1997a). The Feasibility Study assessed how well the following three alternatives would meet the evaluation criteria while controlling migration of contaminants from deep soil to groundwater at the AOC:

- Alternative 1: No action
- Alternative 2: Limited action
- Alternative 3: Biosparging with Ambient Air Monitoring

## B. REMEDIAL/REMOVAL ACTIONS

This section presents the regulatory actions, removal action objectives (RAOs), a description of the selected remedy, and a summary of the remedy implementation at AOC FTA-2/LF-2.

### B.1 Regulatory Actions

**Record of Decision (ROD):** The *Record of Decision for Areas of Contamination FTA-2/LF-2, PFSA/FS-10/FS-11, SD-2/FS-6/FS-8, SD-3/FTA-3/CY-4, and SD-5/FS-5 Source Areas* finalized in September 1998 (AFCEE, 1998) was prepared to document the decision to perform removal actions at several AOCs including FTA-2/LF-2. The selected remedial alternative was Alternative 3, Biosparging with Ambient Air Monitoring. The *Proposed Plan to Cleanup Six Areas of Contamination* (AFCEE, 1997b) was issued in November 1997 for public comment. All comments received at the public hearing and during the public comment period are included in Appendix C of the ROD.

In summary, the remedy provides for:

- Performance of baseline ambient air monitoring
- Collecting confirmation soil samples to refine the horizontal and vertical delineation of the target contaminants ethylbenzene and total xylenes
- Designing and installing a full-scale biosparging treatment system
- Collecting ambient air samples to assess compliance with ARARs

- Maintaining institutional controls that restrict site access and limit potential human exposure to contaminants

## B.2 Removal Action Objectives (RAOs)

The RAOs are site specific qualitative cleanup goals that must be achieved to meet remedial response objectives. The RALs are the site-specific quantitative cleanup levels that will meet these goals. Investigations conducted at the AOC FTA-2/LF-2 demonstrate that source area soil may be a source of release of ethylbenzene and total xylenes to groundwater. Such a release could result in an unacceptable risk to those who drink groundwater at or downgradient of the source area. Therefore the MMR-specific Soil Target Cleanup Levels (STCLs) established for the DSRP (AFCEE, 1996) were retained and used to develop cleanup level concentrations for identified COCs. COCs and respective cleanup levels are presented in **Table B-1**.

Specifically, the RAO established for AOC FTA-2/LF-2 is:

- Reduce ethylbenzene and total xylenes concentrations in FTA-2 soil to less than the leaching-based STCLs of 700 and 10,000 µg/kg, respectively, in order to prevent them from acting as a source of groundwater contamination at AOC FTA-2/LF-2. (AFCEE, 1997a)

<b>Table B-1 Contaminants of Concern and Respective Cleanup Levels for AOC FTA-2/LF-2 Source Areas</b>			
<b>Contaminant</b>	<b>Basis</b>	<b>Concentration (µg/kg)</b>	<b>Standard</b>
Ethylbenzene	Leaching Potential	700	MCP S-1/GW-1
Total Xylenes	Leaching Potential	10,000	Inside Flightline, Human Health Only, MMR Specific

## B.3 Remedy Description

The selected remedy documented in the ROD (AFCEE, 1998) consists of Biosparging with Ambient Air Monitoring. The remedy was selected to reduce levels of contaminants from subsurface soil to meet protective groundwater clean-up concentrations. The selected remedy consists of designing, constructing, and operating a biosparging treatment system, maintaining institutional controls, and conducting five-year reviews of remedy protectiveness.

## B.4 Remedy Implementation

Described below is a summary of the implementation of the remedy. The summary includes Design Optimization, System Installation, System Start-up and Operations and Maintenance Activities.

The biosparge/vapor recovery treatment system installation began on April 24, 2001 and includes: an air compressor; a regenerative blower; a moisture separator; a heat exchanger; carbon vessels; and a condensate holding tank. The system design combined 90 cfm of sparging capacity with 180 cfm of extraction capacity. The air sparge and extraction wells were separated into two zones. The system began operations on September 4, 2001. As of October 2002, approximately 122 pounds of hydrocarbons have been removed (AFCEE, 2002).

## C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The following activities were conducted since the last review.

- Source Areas Remedial Design: Completed September 2000
- Draft Interim Remedial Action Report FTA-2/LF-2 Site: Completed in June 2002

## D. TECHNICAL ASSESSMENT

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA, 2001).

### **Question A: Is the remedy/removal action functioning as intended by the decision documents?**

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. The RAO of mitigating the migration of contaminants to groundwater is being achieved.

### **Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?**

#### Changes in Standards and To-Be Considered

There have been no changes in standards or TBC guidance

#### Changes in Exposure Pathways

There have been no changes in the physical conditions, exposure pathways, and land use of the site that would affect the protectiveness of the removal action.

#### Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for COCs.

#### Changes in Risk Assessment Methods:

There were no changes in risk assessment methodology.

#### Expected Progress Towards Meeting RAOs:

Implementation of the remedy is expected to achieve RAOs.

### **Question C: Has any other information come into light that could call into question the protectiveness of the remedy/removal action?**

There is no information that calls into question of the protectiveness of the selected remedy.

### Technical Assessment Summary

The remedy is functioning as intended by the ROD. There have been no changes in the physical conditions and land use of the site that would affect the protectiveness of the remedy. ARARs and TBC guidance for soil contamination cited in the ROD are being achieved. There is no information that calls into question of the protectiveness of the selected remedy.

**Table D-1** presents the technical assessment summary for AOC FTA-2/LF-2.

<b>Table D-1: Technical Assessment Summary for AOC FTA-2/LF-2</b>		
<b>Question</b>		<b>Response</b>
A	Is the removal action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the removal action?	No

### E. ISSUES

The issues at FTA-2/LF-2 are: the institutional control portion of the selected remedy needs to be implemented; and the treatment system needs to be operated until cleanup goals are achieved.

### F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The recommendations and follow-up actions are: register LF-2 under State requirements; and operate and monitor treatment system until cleanup goals area achieved. The biosparging system at AOC FTA-2/LF-2 should continue operation until the primary shutdown criteria is achieved. If the primary criteria can not be achieved, system shut down should occur only after the two secondary criteria are achieved.

- Primary shutdown criteria: comparison of soil sampling results with approved cleanup levels. If the results are below these cleanup levels, then the primary criteria for system shutdown has been achieved.
- Secondary shutdown criteria: if the in-situ respiration rate has leveled off and is asymptotically approaching a minimum concentration or is near background concentration, and if CO<sub>2</sub> production has reached non-detect or background levels, the system will be considered to have reached it's maximum treatment capacity. After the treatment system has reached its maximum treatment capacity, one of the two secondary criteria for system shutdown will have been achieved.
- Secondary shutdown criteria: if the removal rate of hydrocarbons, as measured at the treatment system, has leveled off to a minimum concentration or no significant change is observed over time, the second secondary criteria for system shutdown will have been achieved.

## G. PROTECTIVENESS STATEMENT

The selected remedy for AOC FTA-2/LF-2 is expected to be protective of human health and the environment upon both its completion and in the interim. Exposure pathways that could result in unacceptable risks are being controlled.

## H. REFERENCES

AFCEE, 2002. *Draft Interim Remedial Action Report FTA-2/LF-2*; Prepared by ECC for AFCEE/MMR Installation Restoration Program, Otis ANGB, Cape Cod, MA; June 2002.

AFCEE, 1998. *Record of Decision for Areas of Contamination FTA-2/LF-2, PFSA/FS-10/FS-11, SD-2/FS-6/FS-8, SD-3/FTA-3/CY-4, and SD-5/FS-5 Source Areas*. Prepared by HLA for AFCEE/MMR Installation Restoration Program, Otis ANGB, Cape Cod MA; September 1998.

AFCEE, 1997b. *Proposed Plan to Cleanup Six Areas of Contamination*; AFCEE/MMR Installation Restoration Program, Massachusetts Military Reservation Otis ANGB, Cape Cod, MA; November 1997.

AFCEE, 1997a. *Final Six Areas of Contamination Source Area Feasibility Study*. Prepared by ABB-ES for AFCEE/MMR Installation Restoration Program, Otis ANGB, Cape Cod, MA; November 1997.

AFCEE, 1996. *Soil Target Cleanup Levels, DSRP*. Prepared by HAZWRAP for AFCEE/MMR Installation Restoration Program, Otis ANGB, Cape Cod MA; January 1996.

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540R-01-007, June 2001.

### 9.3.31 LANDFILL NO.1 (LF-1) SOURCE

#### A. BACKGROUND

##### A.1 Site Description

Area of Contamination (AOC Main Base Landfill-1 (LF-1) Source Area is located on the southern half of MMR and is bounded by Turpentine and Frank Perkins Road to the east and west, and Herbert Road and Connery Avenue to the north and south, respectively (**Figure 11**). The AOC LF-1 source area, which occupies approximately 100 acres of open to heavily wooded terrain, began operating in 1944 as the primary solid waste disposal facility at MMR. From the late 1940s until 1984, unregulated disposal activities were conducted at the site; from 1984 to 1993, the NGB regulated disposal at AOC LF-1 as a component of the MMR Hazardous Waste Management Plan. Disposal at the landfill occurred in six areas (i.e., five distinct cells and a natural kettle hole). The cells are designated by the years representing the approximate end date of waste disposal activities. The six disposal areas include the 1947, 1951, and 1957 cells, referenced as the Northwest Operable Unit (NWOU), which occupy approximately 40 acres of the total AOC LF-1 area; and the 1970 and Post-1970 cells and the Kettle Hole, which occupy approximately 50 acres. The remaining 10 acres comprise the space between the cells. The depth of waste burial has not been accurately determined, but is estimated to be 20 feet bgs for the cells; depth to waste in the Kettle Hole is unknown (E.C. Jordan Co., 1988 and 1990). Approximately 100 additional acres was used in and around the site for construction soil material borrow pits, access roads, staging areas, and cross gradient or downgradient surface water recharge areas (i.e., retention/detention basins).

Accurate documentation of the wastes landfilled at AOC LF-1 does not exist. The wastes are believed to include general refuse, fuel tank sludge, herbicides, solvents, transformer oils, fire extinguisher fluids, blank small arms ammunition, paints, paint thinners, batteries, dichlorodiphenyltrichloroethane (DDT) powder, hospital wastes, municipal sewage sludge, coal ash, and possibly live ordnance.

##### A.2 Initial Response

Not Applicable.

##### A.3 Basis for Taking Action

Investigations conducted to characterize the AOC LF-1 source area between 1983 and 1992 include a records search, site inspections, and remedial investigation, which reached conclusions regarding the effect of the source area on groundwater quality, groundwater migration, and delineation of a plume of groundwater contamination. Consistent with the operable unit approach outlined in the National Contingency Plan, AOC LF-1 was separated into two operable units. Operable Unit I addresses contaminant source control and is the subject of this report. Operable Unit II addresses downgradient groundwater contamination and is recommended for containment and treatment under the MMR Plume Response Plan.

**Focused Feasibility Study:** A focused feasibility study (ABB-ES, 1992) and final design documents (ABB-ES, 1993b) addressed remedial objectives, developed remedial alternatives, analyzed alternatives, and developed a detailed remedial design for the LF-1 source area. The design for contaminant source control was based on an interim remedial strategy to reduce

contaminant leaching, limit migration of liquids through the landfill cells, and maintain compatibility with final remedial measures.

## **B. REMEDIAL/REMOVAL ACTIONS**

This section presents regulatory actions, a description of the selected remedy, and a summary of the remedy implementation at AOC LF-1.

### **B.1 Regulatory Actions**

**Record of Decision:** In 1993, EPA approved and MADEP concurred with the *Record of Decision Interim Remedial Action, Main Base Landfill (AOC LF-1) Source Area Operable Unit, Final January 1993* (ABB-ES, 1993a). The interim remedial plan, referred to as the preferred alternative, addressed AOC LF-1 source control and recommended a method of minimizing further contamination from occurring using containment options evaluated during the focused feasibility study.

### **B.2 Removal Action Objectives (RAOs)**

The interim remedial actions addressed the following response objectives:

- Reduced contaminant leaching to groundwater,
- Minimized migration of liquids through closed landfill cells, and
- Maintain compatibility with the final remedial measures.

### **B.3 Remedy Description**

The selected remedy took action to protect human health and the environment in the short term while additional information is collected to better assess the response of the aquifer and contaminants for remediation efforts. In summary, the interim remedy consisted of (1) constructing a landfill cover system on the 1970 Cell, Post-1970 Cell, and Kettle Hole; (2) conducting post closure maintenance and monitoring of the cover system on these cells for a minimum of 30 years after the completion of the cover; (3) monitoring landfill gas and groundwater quality semiannually and submitting results for regulatory agency review; and (4) NGB and appropriate regulatory agencies reviewing the effectiveness of the AOC LF-1 source interim remedial action every five years.

### **B.4 Remedy Implementation**

The interim remedial action for the LF-1 Landfill focused on minimizing further environmental impacts from the 1970, Post-1970, and the Kettle Hole cells.

**LF-1 Site Closure Report:** In accordance with the ROD for interim action, the NGB proceeded to cap the three most recently used cells (approximately 60 acres) because it was determined that they were the sources of the groundwater contamination. The *AOC LF-1 Main Base Landfill Site Closure Report* was finalized in September 1996 (ABB-ES, 1996). The final design consisted of installing a composite cover system over the 1970 Cell, Post-1970 Cell, and Kettle Hole, which conforms to Resource Conservation and Recovery Act guidance, and includes the following components from top to bottom: vegetative, material layer, sand filter layer, drainage sand layer, geo-membrane, geo-synthetic clay liner, gas-venting sand layer, subgrade fill material.

**Landfill cap monitoring:** The long-term monitoring program as defined in the post-closure plan was implemented as required by the ROD for interim action. The plan describes regulatory requirements for monitoring the newly constructed landfill caps. Landfill cap monitoring is documented in the LF-1 Annual System Performance and Ecological Impact Monitoring Reports (AFCEE, 2002).

LF-1 post-closure monitoring includes semiannual groundwater sampling at eight monitoring wells and annual groundwater sampling at eight additional wells at the three capped LF-1 cells, quarterly screening of landfill gas at 12 gas probes surrounding the perimeter of the LF-1 cover system, semiannual site inspections, annual settlement monitoring of the three capped cells, and periodic, maintenance of the cover system (AFCEE, 2002).

Groundwater at the post-closure monitoring wells is analyzed for volatile organic compounds (VOCs), ethylene dibromide (EDB), total dissolved solids (TDS), chemical oxygen demand (COD), common anions (chloride, nitrate, nitrite, orthophosphate, sulfate), pesticides, polychlorinated biphenyls (PCBs), explosives, and total metals including cyanide. Twelve gas probes are monitored to detect changes in the concentration of the landfill gas at the perimeter of the landfill (AFCEE, 2002).

Site monitoring (visual inspections) documents the physical condition of the landfill cover system, including the perimeter fence, the vegetated cover, monitoring wells, gas probes, and the drainage system. Findings are documented in a landfill site inspection summary. (AFCEE, 2002)

Settlement monitoring verifies that adequate slopes, designed to shed precipitation from the caps, are being maintained. If settlement causes the top slope of the cap to decrease below 2 percent grade or if the adjacent survey stations show differential settlement greater than 1 foot, maintenance activities will be conducted. Maintenance activities performed at the landfill include mowing the cover system two times per year, along with other needs addressed in the site inspection summaries (e.g., filling erosion rills or clearing drainage culverts) (AFCEE, 2002).

## **C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW**

Groundwater has been monitored on a semiannual basis. Results have been presented in Annual System Performance and Ecological Impact Monitoring Reports.

## **D. TECHNICAL ASSESSMENT**

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA, 2001).

### **Question A: Is the remedy/removal action functioning as intended by the decision documents?**

The review of documents, site inspections and annual system performance and ecological impact monitoring activities demonstrate that the remedy is functioning as intended by the ROD.

**Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?**

Changes in Standards and To-Be Considered

There have been no changes in standards and to-be considered guidance documents.

Changes in Exposure Pathways

There have been no changes in the physical conditions, exposure pathways, and land use of the site that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for contaminants of concern that were used for the human health risk assessment.

Changes in Risk Assessment Methods:

There were no changes in human health risk assessment methodology.

Expected Progress Towards Meeting RAOs:

Implementation of the selected remedy has achieved RAOs.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy?**

There is no information that calls into question of the protectiveness of the selected remedy.

**Technical Assessment Summary**

**Table D-1** presents the technical assessment summary for the AOC LF-1 Source.

<b>Table D-1: Technical Assessment Summary for the AOC LF-1 Source</b>		
<b>Question</b>		<b>Response</b>
A	Is the remedial action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedial action selection still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the remedial action?	No

**E. ISSUES**

No issues have been identified.

## F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Long term monitoring as well as landfill cap operation and maintenance activities shall continue as required by the ROD for Interim Action. AOC LF-1 shall be reviewed again in five years.

## G. PROTECTIVENESS STATEMENT

The selected remedy for AOC LF-1 is expected to be protective of human health and the environment upon both its completion and in the interim. Exposure pathways that could result in unacceptable risks are being controlled.

## H. REFERENCES

ABB –ES, 1996. *AOC LF-1 Main Base Landfill Site Closure Report*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Oak Ridge, Tennessee; September 1996.

ABB –ES, 1993b. *Closure Plan for Area of Contamination LF-1 1970 Cell, Post-1970 Cell, and kettle Hole Technical Specifications*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; March 1993.

ABB –ES, 1993a. *Record of Decision for the Interim Remedial Action of the Main Base Landfill (AOC LF-1) Source Area Operable Unit*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; January 1993.

ABB Environmental Services, Inc (ABB-ES), 1992. *Focused Feasibility Study for the Main Base Landfill (AOC LF-1)*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; June 1992.

E.C. Jordan Co., 1990. *Task 2-3B Site Inspection, Field Investigation Work Conducted Spring-Summer 1988*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; February 1990.

E.C. Jordan Co., 1988. *Field Investigations, Summer/Fall 1986; Task 2-1; Base Landfill, Petroleum Fuels Storage Area, and Fire-Training Area*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; July 1998.

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540R-01-007, June 2001.

## 9.3.32 LANDFILL NO.1 (LF-1) GROUND WATER

### A BACKGROUND

#### A.1 Site Description

The LF-1 plume is a chlorinated VOC plume that originated from the Main Base Landfill (LF-1 Landfill) and a former motor pool located immediately to the southeast of the landfill, designated as CS-9. Investigations to characterize the LF-1 plume began in 1988 (E.C. Jordan Co., 1990). **Figure 9.3.32-1** presents the LF-1 plume as of December 2002. The plume is defined by MCL exceedences for PCE, TCE, and carbon tetrachloride.

#### A.2 Initial Responses

Three cells of the LF-1 landfill were "capped" in 1995. Capping the landfill eliminated the infiltration of rainwater thereby reducing the movement of contaminants from the landfill to the groundwater. The cap covers about 60 acres of the 100-acre former landfill site. The landfill cap consists of several layers, including a geo-synthetic clay liner, a geo-membrane, sand, and vegetation to prevent erosion (ANG, 1996).

CS-9 contaminated soils and underground drainage structures were removed during the summer of 1994 as part of the LF-1 Landfill capping project (AFCEE, 2002a).

#### A.3 Basis for Taking Action

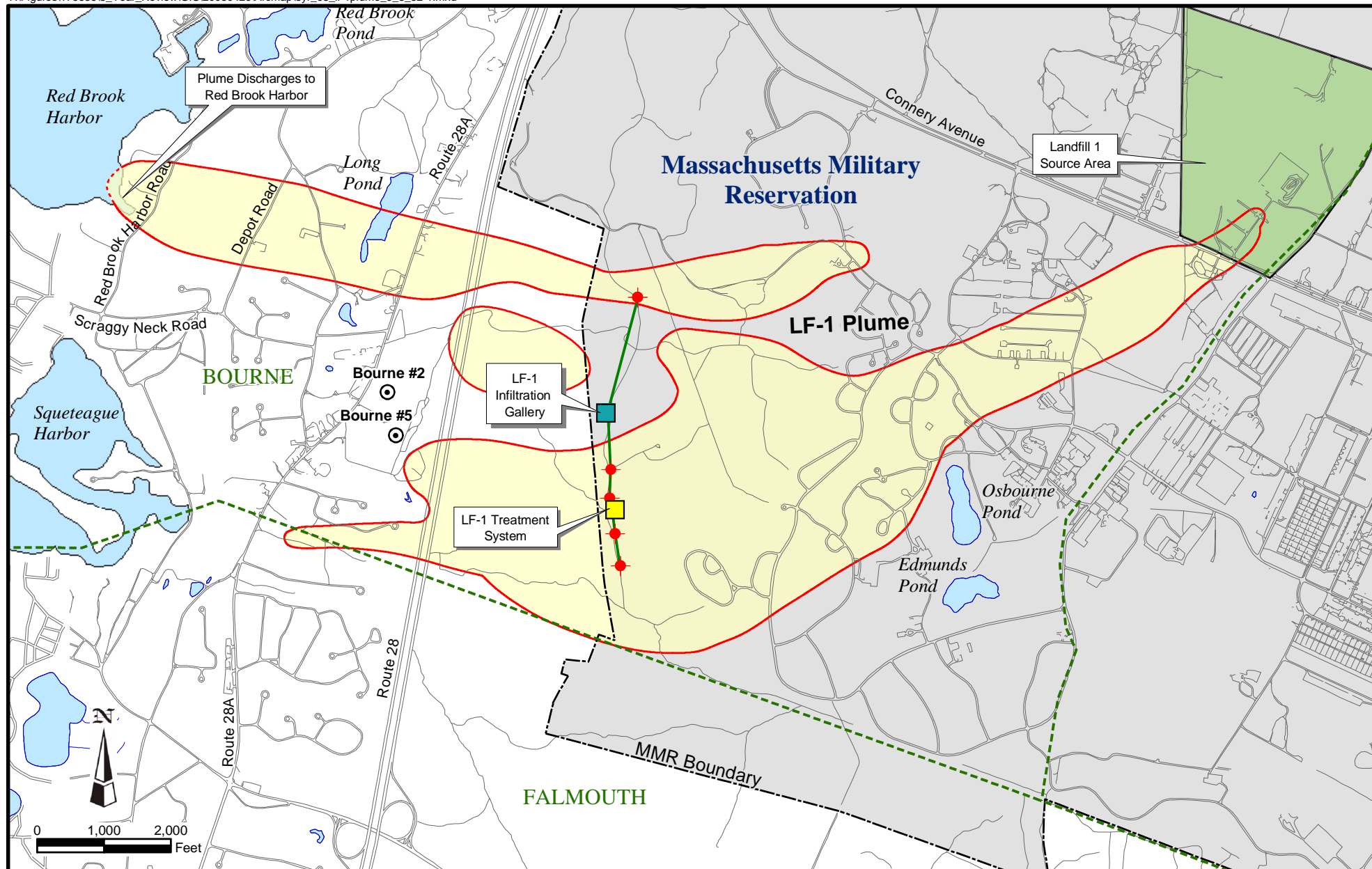
An RI was completed in 1996 (AFCEE, 1996) to determine the nature and extent of groundwater contamination resulting from past disposal practices at the landfill. Human and ecological risk assessments were conducted as part of the RI. Carbon Tetrachloride, PCE, and TCE were identified as COCs in the *Final Record of Decision for Interim Action Containment of Seven Groundwater Plumes* (known as the IROD) (ANG, 1995). Please note that the LF-1 plume is one of the seven groundwater plumes included in the Interim Record of Decision (IROD) (ANG, 1995), and is currently undergoing the IROD to Final ROD process. As part of the IROD to ROD process, COCs will be identified for the final ROD. **Table A-1** presents interim action COCs and respective cleanup levels.

<b>Table A-1 Interim Action Contaminants of Concern and Respective Cleanup Levels for the LF-1 Plume</b>			
<b>Contaminant</b>	<b>Basis</b>	<b>Conc (µg/l)</b>	<b>Standard</b>
PCE	Human Health	5	Fed MCL
TCE	Human Health	5	Fed MCL
Carbon Tetrachloride	Human Health	5	Fed MCL

### B REMEDIAL ACTIONS

This section presents the regulatory actions, remedial action objectives (RAOs), and remedy description for the LF-1 Plume.

#### B.1 Regulatory Actions



## Legend

- Plume Contour = Concentrations exceeding drinking water standards or Maximum Contaminant Level (MCL). Represents an exceedance of trichloroethene (TCE), perchloroethene (PCE), and/or carbon tetrachloride (CCl<sub>4</sub>).  
(TCE MCL = 5 µg/L)  
(PCE MCL = 5 µg/L)  
(CCl<sub>4</sub> MCL = 5 µg/L)

- Treatment System
- Infiltration Gallery
- Town Boundary
- Treatment System Piping
- Extraction Well
- Public Water Supply Well



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Cape Cod, Massachusetts

As stated in the IROD, the interim remedial action for the seven plumes is designed to intercept the contaminated groundwater plumes to prevent further downgradient movement of the contaminants. The IROD states that extraction and treatment will continue until the final remedy for the site is chosen. The interim and final remedies must be consistent with the clean-up goals for the entire MMR site.

In summary, the interim remedy as outlined in the IROD provides for:

- extracting contaminated groundwater at the leading edge of contaminant plumes and potentially extracting groundwater from hot spot areas identified during remedial design;
- pumping and conveying the extracted groundwater to a treatment system to remove contaminants;
- discharging the treated water back to the groundwater and/or other beneficial use;
- installing monitoring wells, measuring water levels, and sampling groundwater to monitor the performance of the extraction system;
- sampling the influent and effluent of the treatment system to monitor its performance;
- restricting groundwater use within the areas contained by the ETR through imposition of institutional controls; and
- conducting a review after five years of operation to ensure the remedy provides adequate protection of human health and environment.

After it was determined that the 60% design for containment of all the IROD plumes would cause negative ecological impacts, the remedy for LF-1 was revised through the Decision Criteria Matrix (DCM) process which included public participation. The process used a matrix with decision criteria that focused on protection of human health and the environment, regulatory requirements, effectiveness of treatment technologies, and community acceptance.

On December 12, 1997, AFCEE, USEPA, and MADEP reached a final agreement for the western portion of the LF-1 plume (i.e., west of Route 28). The remedy would consist of monitoring of chlorinated VOCs, which would include sampling of both groundwater and surface water. The decision was documented in a Plume Response Decision factsheet (AFCEE, 1997).

For the eastern portion of the plume (i.e., east of Route 28), AFCEE evaluated remedial alternatives in a Landfill 1 Proposed Response Document (AFCEE, 1998a), Focused Feasibility Study (FFS) (AFCEE, 1998b), and supplement to the FFS (AFCEE, 1998c). The selected alternative included constructing an ETR system and conducting MNA for the LF-1 plume east of Route 28. The decision was documented in a Plume Response Decision factsheet (AFCEE, 1998d).

## **B.2 Remedial Action Objectives**

The objectives were defined in the IROD and DCM process and were used as the basis for determining cleanup goals.

The objectives in the IROD are described as follows:

- reduce the risks to human health associated with the potential future consumption and direct contact with groundwater and surface waters;
- protect uncontaminated groundwater and surface waters for future use by minimizing the migration of contaminants;
- reduce potential ecological risks to surface waters and through the implementation of the containment system; and,
- restore aquifer (within confines of the LF-1 plume) to its beneficial uses with a 20 year timeframe.

### **B.3 Remedy Description**

The selected remedy for the LF-1 Plume is documented in the Plume Response Decision factsheets (AFCEE, 1997 and AFCEE, 1998d). For the portion of the plume east of Route 28, the selected remedy included operation of the ETR system (north plume zone and south plume zone), monitoring of natural attenuation of chlorinated VOCs (central plume zone only), connecting residences that are on private wells located within the present or potential path of the LF-1 plume to public water supplies, and replacing Bourne public water supply wells #2 and #5 in 1999. For the western part of the plume, the selected remedy is MNA of chlorinated VOCs.

### **B.4 Remedy Implementation**

#### ETI System:

The treatment system began operation on August 26, 1999. Effluent is discharged into an infiltration gallery and two infiltration trenches rather than reinjected. The extraction system uses four partially penetrating extraction wells within the southern lobe and one in the northern lobe. These five extraction wells were designed to capture the higher COC concentrations within the southern and northern lobes at a combined design extraction rate of 700 gpm. The influent is processed through a modular GAC treatment plant that also includes a sodium hypochlorite injection system to reduce biofouling. Once the extracted groundwater is treated, it is released to an infiltration gallery located near the MMR boundary within a relatively clean groundwater zone, situated between the northern and southern lobes of the LF-1 plume.

#### Direct Impact and Ecological Monitoring:

A direct impact monitoring program has been implemented to identify impacts to the ecosystem from extracting contaminated groundwater or from adding treated water through infiltration.

#### Monitored Natural Attenuation

For the eastern portion of LF-1 Plume, groundwater is monitored for natural attenuation in conjunction with operating the ETI system. Long-term monitoring is performed for the western portion of the LF-1 plume.

#### Bourne Public Water Supply Well Monitoring:

Three monitoring wells, located upgradient of the Bourne water supply wells #2 and #5, are sampled monthly to ensure that LF-1 plume constituents are not threatening these public wells. Three additional wells also are sampled, but on a quarterly basis. Analytical results from samples collected during August 2000- July 2001 did not identify any contaminants above the drinking water standards (AFCEE, 2002b).

#### Residential Well Monitoring:

Monitoring of residential wells located within the present or potential path of the LF-1 plume begun in 1996 to ensure that no plume constituents are present in private water supplies. The majority of residents have been connected to public water. This sampling work will continue until the potentially effected homes with private wells are connected to public water supplies.

### **C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW**

The following activities were conducted/observed since the last review based on information presented in the

- ETI system startup: Completed in August, 1999.
- Final LF-1 Well Field Design Report: Completed in October, 1999 (AFCEE, 1999).
- LF-1 Interim Remedial Action Report: Completed in March, 2002 (AFCEE, 2002a).

### **D. TECHNICAL ASSESSMENT**

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA 2001). **Table D-1** summarizes the technical assessment.

#### **Question A: Is the remedy functioning as intended by the decision documents?**

Yes, the interim remedy is functioning as intended by the IROD and LF-1 Plume Response Decision Factsheets. AFCEE is currently completing the IROD to ROD process, which may alter the interim remedy based on results of current groundwater monitoring data and system remedial performance data, as well as conclusions of risk assessments using current data.

#### **Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**

##### Changes in Standards and To Be Considered

There have been no changes in standards or TBC guidance.

##### Changes in Exposure Pathways

There have been no changes to exposure pathways and land use of the site that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for COCs.

Changes in Risk Assessment Methods:

There were no changes in risk assessment methodology.

Expected Progress Towards Meeting RAOS:

The system is making progress of completing the cleanup for the eastern portion of the plume within the estimated timeframe of 20 years. Through July 2001, the LF-1 treatment system has removed approximately 98 lbs of COCs. This represents approximately 7.5% of the estimated COC mass (1,320 lb) in the LF-1 plume (AFCEE, 2002b).

Natural attenuation for the western portion of the plume appears to be occurring. No changes are expected to address chlorinated VOCs present in the plume west of Route 28. The ETI/MNA alternative is achieving RAOs, however, the extraction component could be optimized.

Mitigation of exposure of contaminated groundwater to humans has included connecting potentially impacted residents to drinking water. Furthermore, samples collected from the upgradient wells of the Bourne water supply show that chlorinated VOCs are in general, below their respective MCLs (AFCEE, 2002b).

The LF-1 plume is not currently impacting ecosystems. Chlorinated VOCs are below their MCLs and AWQCs for protection of aquatic life in samples collected from seep locations into Squeteague and Red Brook Harbors. The LF-1 plume does not discharge to freshwater bodies. Extraction and discharge of treatment effluent is not having deleterious effects on the aquifer or on ecologically sensitive surface water bodies.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy?**

No.

**Technical Assessment Summary:**

Table D-1: Technical Assessment Summary for the LF-1 Plume		
Question Item	Question	Response
A	Is the removal action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are valid?	Yes
C	Has information come to light that calls into question the protectiveness of the remedy?	No

## **E. ISSUES**

The issue for LF-1 groundwater is a final remedy is required.

## **F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

The recommendations and follow-up actions are: a final remedy should be selected and documented in a final ROD, LF-1 groundwater treatment system operations including monitoring should continue until RAOs have been achieved, and the treatment system should be optimized as needed.

## **G. PROTECTIVENESS STATEMENT**

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, which is expected to require 20 years. In the interim, exposure pathways that could result in unacceptable risks are being controlled by the existing ETI system and connecting residents potentially impacted by the LF-1 plume to public water supply.

All threats at the site have been addressed by the implementation of the remedy [i.e., operation of the ETI system (eastern portion of plume), monitoring of natural attenuation of chlorinated VOCs (western portion of plume), and connecting the majority of potentially impacted residences to the Bourne Water District water supply].

Long-term protectiveness of the remedial action will be verified by results of groundwater monitoring and system remedial performance monitoring. Current monitoring data indicate that the remedy is functioning as required to achieve groundwater cleanup goals.

## **H. REFERENCES**

AFCEE, 2002b. *Final Landfill-1 2001 Annual System Performance and Ecological Impact Monitoring Report*. Prepared by Jacobs Engineering for AFCEE/MMR, Installation Restoration Program, Otis ANG Base, MA. July, 2002

AFCEE, 2002a. *Final Landfill-1 Interim Remedial Action Report*. Prepared by Jacobs Engineering for AFCEE/MMR, Installation Restoration Program, Otis ANG Base, MA. 2002

AFCEE, 1999. *Final Landfill-1 Wellfield Design Report*. Prepared by Jacobs Engineering for AFCEE/MMR, Installation Restoration Program, Otis ANG Base, MA. October 1999

AFCEE, 1998d *Landfill-1 (LF-1) Plume Response Decision Fact Sheet*. Prepared by AFCEE, Installation Restoration Program, Otis ANG Base, MA December 1998

AFCEE, 1998c *Supplement to the Focused Feasibility Study for Landfill-1* Prepared by Parsons Engineering Science, Inc. for AFCEE/MMR, Brooks AFB TX October 1998

AFCEE, 1997 *Landfill-1 (LF-1) Plume Response Decision Fact Sheet*. Prepared by AFCEE, Installation Restoration Program, Otis ANG Base, MA.

AFCEE, 1996 *Final Remedial Investigation Main Base Landfill (AOC LF-1) and Hydrogeologic Region I Study*. Prepared by HAZWRAP for AFCEE/MMR, Installation Restoration Program, Otis ANG Base, MA September 1996.

ANG, 1996. *AOC LF-1 Main Base Landfill Site Closure Report*. Prepared by ABB Environmental Services for ANG Readiness Center , Installation Restoration Program, Otis ANG Base, MA. September, 1995

ANG, 1995. *Final Record of Decision Interim Remedial Action Containment of Seven Groundwater Plumes at MMR, Cape Cod MA* Prepared by Stone & Webster Environmental & Technology Services for ANG Readiness Center , Installation Restoration Program, Otis ANG Base, MA. September, 1995

E.C. Jordan Co. 1990. Task 2-3B Site Inspection, Field Investigation Work Conducted Spring-Summer 1988' Prepared for ANG Readiness Center, Installation Restoration Program, Otis ANG Base; February 1990

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540R-01-007, June, 2001.

### 9.3.33 LANDFILL NO.7 (LF-7) SOURCE

#### A. BACKGROUND

##### A.1 Site Description

Study area LF-7 is approximately 400 square feet and is located in a gravel pit north of the LF-1 (Figure 11). It is an area where radioactive electron tubes, removed from EC-121 aircraft radar sets, were reportedly buried. The number buried is unknown, however, since approximately 200 tubes/year were removed from aircraft between 1955 and 1970, it is estimated that as many as 3,000 tubes may be buried.

##### A.2 Initial Response

Not Applicable.

##### A.3 Basis for Taking Action

In response to discussions with the USEPA on May 19, 1992, the ANG investigated the nature of the radioactive isotopes used in the radar tubes potentially disposed of at LF-7. Based in discussions with ANG and USAF personnel, the most likely radioactive isotopes used in the electron tubes were: Cesium-137, Tritium, Nickel-63, Cobalt-60, and Radium-226 (ABB-ES, 1993).

These radar electron tubes are believed to have contained very low, near background, levels of radioactive material ranging from  $10^{-7}$  to  $10^{-9}$  picoCuries (pCi). Using the estimated number of tubes and their pCi range, the total radioactivity at this study area is calculated to be  $3 \times 10^{-4}$  to  $3 \times 10^{-6}$  pCi range. It was concluded that were the entire amount of radioactivity to be contained in one liter of water, the level of radioactivity would be, at worst,  $3 \times 10^{-4}$  pCi/L. The USEPA Interim Primary Drinking Water Standards for radium and gross Alpha radioactivity are 5 pCi/L and 15 pCi/L, respectively. The worst-case concentrations calculated above are negligible compared to federal standards. Actual concentrations maybe considerably lower than the worst-case scenario calculation (ABB-ES, 1993).

Because of the uncertainty in the identification of the isotope(s) potentially disposed of at LF-7, specific discussions regarding the radioactive half-life(s) could not be made. The half-lives of the likely isotopes used in the radar electron tubes extend from approximately 5 to 1,620 years. Therefore, the radioactivity in these tubes, which were potentially disposed of between 1955 and 1970, were calculated to range from less than 1 percent to 100 percent of the amount present at the time of the suspected disposal (ABB-ES, 1993).

#### B. REMEDIAL/REMOVAL ACTIONS

This section presents regulatory actions, a description of the selected remedy, and a summary of the remedy implementation at study area LF-7.

##### B.1 Regulatory Actions

Provided below is the controlling document that present the official decision.

**Decision Document Radar Tube Burial Landfill (LF-7):** The LF-7 DD was completed in November 1993. This Decision Document concluded that based on the level of radioactive materials contained in the tubes, the potential hazard from the suspected disposed radar tubes is negligible. The decision document states that radiological studies at similar disposal study areas have not indicated contamination or human health impact.

## **B.2 Remedial Action Objectives (RAOs)**

Not Applicable

## **B.3 Remedy Description**

The decision document presents the following decision: The National Guard Bureau has reviewed the available data and concludes that no further actions are required to Study Area LF-7. Although the suspected hazard at LF-7 is negligible, site access restrictions are maintained as part of military operations at MMR. The decision document requires the construction of a fence surrounding the study area to prevent unauthorized entry and excavation activities, the posting of appropriate radioactive warning labels, and the conducting of annual radiological surveys.

## **B.4 Remedy Implementation**

The following institutional and engineering controls have been implemented:

The study area shall be operated in full accordance with AFOMS/SGPR policy letter of August 9, 1988. This policy specifies that areas used for disposal of low-level radioactive wastes will be appropriately fenced to prevent unauthorized entry, marked with appropriate radioactive warning labels, and monitored annually to verify that actual levels of radioactivity remain acceptable. In addition to the fencing surrounding the disposal site, and in response to USEPA concerns, an area surrounding LF-7 will be posted by the ANG to prevent excavation. The area to be posted will be determined by the ANG based on the existing site conditions (i.e., tree cover, accessibility).

The annual radiological survey will be conducted with a Model 471 Radio Frequency Survey Meter. The 20-foot by 20-foot area will be surveyed at the ground surface and 3 feet above. The specifications of the monitoring instrument are provided in attachment D of the Decision Document. While this instrument does not detect alpha radiation, monitoring of alpha radiation is not necessary as long as the soil is not disturbed. If the soil is disturbed, air sampling will be conducted to detect alpha radiation. High and/or low volume air samplers will be used. Air filters will be screened on-site with ZnS scintillation counter, gas proportional counter, or sent off-site for laboratory analysis.

These institutional controls are to be implemented as long as MMR remains a military base. Levels of radioactivity considered acceptable are (1) 2 milli Roentgen/hr, whichever is lower (Nuclear Regulatory Commission regulations 10 CFR 20.105).

## **C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW**

The following activities were conducted since the last review.

- Completed annual radiological surveys and site inspections as required by the decision document.

**D. TECHNICAL ASSESSMENT**

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA, 2001).

**Question A: Is the remedy/removal action functioning as intended by the decision documents?**

The review of documents and the results of annual site inspections and radiological surveys indicate that the remedy is functioning as intended by the Decision Document. Annual air monitoring has been conducted since 1990 (13 years). There has never been a radiation reading above background levels.

**Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?**Changes in Standards and To-Be Considered

There have been no changes in standards and to-be considered guidance documents.

Changes in Exposure Pathways

There have been no changes in the physical conditions, exposure pathways, and land use of the site that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics

Not Applicable.

Changes in Risk Assessment Methods:

Not Applicable

Expected Progress Towards Meeting RAOs:

Not Applicable.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy?**

There is no information that calls into question of the protectiveness of the selected remedy.

**Technical Assessment Summary**

The remedy is functioning as intended by the decision document. There have been no changes in the physical conditions and land use of the site that would affect the protectiveness of the remedy. There is no information that calls into question of the protectiveness of the selected remedy.

Table D-1 presents the technical assessment summary for AOC LF-7.

Table D-1: Technical Assessment Summary for AOC LF-7		
Question		Response
A	Is the removal action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the removal action?	No

#### E. ISSUES

For the review period, there are no issues at LF-7.

#### F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Since there are no issues, there are no recommendations or follow-up actions at this time. Periodic monitoring and site inspections should continue.

#### G. PROTECTIVENESS STATEMENT

The selected remedy for Study Area LF-7 is expected to be protective of human health and the environment upon both its completion and in the interim. Exposure pathways that could result in unacceptable risks are being controlled.

#### H. REFERENCES

ABB Environmental Services, Inc (ABB –ES), 1993. *Decision Document Radar Tube Burial Landfill (LF-7 Study Area)*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; November 1993.

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540R-01-007, June 2001.

### 9.3.34 STORM DRAIN NO.4 (SD-4) SOURCE

#### A. BACKGROUND

##### A.1 Site Description

Area of Contamination (AOC) SD-4 is a mostly wooded drainage basin located in the southeastern section of MMR which extends from the flightline security area immediately east of Hangar 124 approximately 3,500 feet south towards Johns Pond (**Figure 11**).

The drainage basin, which became operational in 1950, received stormwater drainage from storm sewers that lead from Hangars 158, 128, 126, and 124, including the buildings, runways, ramps, and decks that serve the four hangars in addition to the former Building 123 pumphouse area. The drainage basin also reportedly received flow from numerous spills and liquids disposal during daily operations at these facilities. In 1968, an oil/water separator was constructed in the drainage basin south of Reilly Road.

The primary environmental concerns at AOC SD-4 are the effects of these releases on surface soil, subsurface soil, surface water, and groundwater. It was estimated that approximately 0.5 to 1.4 million gallons of petroleum distillate solvents was released to the SD-4 stormwater drainage system from Hangar 158. These solvents used in daily operations at support shops located in the hangar, were reportedly dumped into hangar deck drains connected to the storm drain system (ABB-ES, 1992).

From 1955 to 1970, Hangar 128 was used to maintain 18 to 21 aircraft. During that time, known quantities of solvents were released into the storm drain system. From 1978 to 1988, the hangar was used by the U.S. Coast Guard for aircraft maintenance. Periodic heating of the wing tanks of the aircraft resulted in numerous spills of AVGAS to the hangar deck; a portion of it was washed into the storm drain system. In 1978, a spill of approximately 1,000 gallons of AVGAS occurred outside the hangar; it was also flushed into the storm drain system. The nature and extent of these individual spills were also investigated as part of the Site Investigation for CS-4(USCG) and FS-1 (USCG), which are located northwest of AOC SD-4 (ABB-ES, 1992).

##### A.2 Initial Response

The pumphouse at former Building 123 served four 25,000 gallon USTs that were used to store JP-4 jet fuel. The building and associated USTs were removed in April 1993 along with 70 cy of contaminated soil, based on open air screening with a PI meter and olfactory and visual observations (Metcalf & Eddy, 1993). Final headspace screening of soil samples from the excavation sidewalls and base using standard MADEP procedures produced results below 10 ppm total VOCs. In addition, trenching was performed to expose and remove fuel lines leading to the jet fueling area. Screening results did not indicate the presence of fuel contaminated soil in fuel line trenches.

##### A.3 Basis for Taking Action

SD-4 has been investigated several times since 1989.

**Site Investigation (SI):** The AOC SD-4 SI was conducted in two phases (Phases I and II) between 1989 and 1991 by ABB-ES (ABB-ES, 1993). The SI included a soil gas survey, sediment sampling,

excavation of test pits, and installation of monitoring wells. A sample of liquid and sediment in the gas trap associated with Building 123 was also collected.

**Remedial Investigation (RI):** The RI for AOC SD-4 further characterize potential soil and groundwater contamination identified in the SI, evaluate site hydrogeology, and assess potential risks to human health and the environment posed by contaminants in the AOC. The field exploration program for AOC SD-4 included surface soil samples at 14 locations (six of which were for SVOCs only), advancing five test borings, installing four new groundwater monitoring wells, collecting one round of groundwater samples from 11 monitoring wells, sediment sampling at nine locations, and surface water sampling at seven locations. Other data collected during the hydrogeologic investigation included depths to static groundwater, in-situ hydraulic conductivity test data on selected existing and newly installed monitoring wells, and performing grain-size distribution and total organic carbon analysis of sediment samples (CDM Federal Programs Corporation, 1996).

**Risk Evaluation Summary:** The RI report for AOC SD-4 included a human-health Preliminary Risk Assessment (PRA) to evaluate potential human-health risks associated with exposure to contaminated surface soil, groundwater, pond sediment, pond surface water, and wetland surface water under current and future site conditions. The AOC SD-4 PRA report evaluated potential ecological risks associated with exposure to contaminated surface soil (zero to 2 feet bgs), sediment, and surface water. Evaluations were made for exposure of various ecological receptors to the following media at AOC SD-4: surface soil and pond surface water; pond sediment and pond surface water; and wetlands sediment and wetlands surface water. The results of the PRA triggered the need for an evaluation of remedial alternatives (i.e. Feasibility Study).

The contaminants of concern (COCs) identified for sediments at AOC SD-4 are the SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-c,d)pyrene, phenanthrene; and inorganics: aluminum, cadmium, copper, cyanide, lead, vanadium, and zinc. However, due to specific correlation factors (i.e. relatively low water solubility and a tendency to sorb to soil and sediment) TPH was chosen as a surrogate for the SVOCs.

**Feasibility Study:** AOC SD-4 was included as part of the Six Areas of Contamination Source Area Feasibility Study completed in November 1997 (AFCEE, 1997a). The Feasibility Study assessed how well the following three alternatives would meet the evaluation criteria while controlling migration of contaminants from deep soil to groundwater at the AOC:

- Alternative 1: No Action
- Alternative 4: Excavation/Asphalt Batching
- Alternative 5: Excavation/Off site Treatment and Disposal

## **B. REMEDIAL/REMOVAL ACTIONS**

This section presents the regulatory actions, removal action objectives (RAOs), a description of the selected remedy, and a summary of the remedy implementation at AOC SD-4.

## B.1 Regulatory Actions

Described below is the controlling document that presents the selected remedy.

**Record of Decision (ROD):** The *Record of Decision for Areas of Contamination FTA-2/LF-2, PFSA/FS-10/FS-11, SD-2/FS-6/FS-8, SD-3/FTA-3/CY-4, and SD-5/FS-5 Source Areas* finalized in September 1998 (AFCEE, 1998) was prepared to document the decision to perform removal actions at several AOCs including SD-4. The selected remedial alternative for the SD-4 source area was Alternative 2, Excavation/Asphalt Batching. The *Proposed Plan to Cleanup Six Areas of Contamination* (AFCEE, 1997b) was issued in November 1997 for public comment. All comments received at the public hearing and during the public comment period are included in Appendix C of the ROD.

## B.2 Removal Action Objectives (RAOs)

The RAOs are site specific qualitative cleanup goals that must be achieved to meet remedial response objectives. The RALs are the site-specific quantitative cleanup levels that will meet these goals. The following RAOs were established for AOC SD-4:

- Prevent human and ecological exposure to shallow (zero to 2 feet bgs) drainageway soil and sediment contaminated with TPH exceeding 500 ppm.
- Manage pond sediments to prevent surface water contamination with SVOCs at concentrations which present potential risks to human receptors exceeding the USEPA cancer risk management range.
- Manage pond sediments to prevent surface water contamination at concentrations exceeding chronic ambient water quality criteria.

## B.3 Remedy Description

The selected remedy is Excavation/Asphalt Batching. This alternative provides institutional and engineering controls for areas north of Reilly Road to limit exposure to site-related contaminants in soil and to reduce source-area contaminant concentrations to protective levels. For areas south of Reilly Road, this alternative provides for additional sampling and engineering controls to assess the contribution of sediment contaminants to surface water contamination, the potential bioavailability and toxicity of pond sediments, and, if necessary, removal of source area sediments exceeding cleanup criteria and treatment of excavated material to reduce contaminant mobility. The risk assessment did not identify the need to clean up groundwater at this AOC; consequently, the remedy does not include a management of migration component.

In the event that excavation of contaminated soil was warranted, confirmatory sampling after excavation would ensure that all soil with COC concentrations exceeding approved cleanup levels were removed. Excavated soil that is found to contain contaminant concentrations in exceedance of TCLP allowable concentrations would be deemed hazardous and disposed of off-site in a RCRA Subtitle C TSDF. Soil that has contaminant concentrations below TCLP allowable concentrations (and that were determined to contain contaminant concentrations below MADEP MCP Method 1 S-1/GW-1 standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels) would be deemed nonhazardous and treated at the on-site cold mix emulsion asphalt-batching plant.

## B.4 Remedy Implementation

**Ecological Evaluation of the AOC SD-4 Site:** In accordance with the selected remedy for AOC SD-4, pre-excavation studies at the AOC pond focused on surface water quality, on the bioavailability of inorganic contaminants, and on evaluation of pond/wetland structure and productivity to assess whether adverse effects are actually occurring and whether sediment remediation was justified (AFCEE, 2002).

This ecological evaluation of SD-4 documents the overall ecological health of the SD-4 pond and surrounding area. The risk characterization indicated no or minimal adverse environmental impacts to indicator species at SD-4. Exposure modeling reduced COCs in sediment to a single element (i.e. aluminum). According to the evaluation, AOC SD-4 is a viable jurisdictional wetland which provides habitat for native insects, amphibians, reptiles and birds. This evaluation concluded that the pre-excavation studies stipulated by the SD-4 ROD have been performed and indicate that the remediation of sediments in SD-4 is not justified. It was recommended that the sediments in the SD-4 pond remain undisturbed and that actions to remediate those sediments be discontinued. Because metals with concentrations above their RALs were found in surface soil adjacent to the pond, additional ecological risk evaluation was planned to determine if any soil removal is needed.

**Ecological Risk Assessment for AOC SD-4:** AFCEE is currently readdressing the Ecological Risk Assessment for surface soil at AOC SD-4 based on new USEPA risk assessment guidance. Finalization of this new risk assessment and a decision on the need for further action is anticipated in 2003.

## C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The following activities were conducted since the last review.

- Source Areas Remedial Design: Completed September 2000
- Ecological Evaluation of the AOC SD-4 Site: Completed in 2002.

## D. TECHNICAL ASSESSMENT

The technical assessment component of the five-year review consists of evaluating the protectiveness of the removal action. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA, 2001).

### **Question A: Is the remedy/removal action functioning as intended by the decision documents?**

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. The ecological evaluation for sediments at AOC SD-4 indicated that the RAOs of mitigating the migration of contaminants to groundwater and preventing direct contact with, or ingestion of contaminants in soil has been achieved. However, at this time an ecological risk assessment for AOC SD-4 soil is underway.

### **Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?**

Changes in Standards and To-Be Considered

AFCEE is currently performing an ecological risk assessment on AOC SD-4 soil based on new USEPA risk assessment guidance.

Changes in Exposure Pathways

There have been no changes in the physical conditions, exposure pathways, and land use of the site that would affect the protectiveness of the remedy/removal action.

Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for contaminants of concern that were used for the human health risk assessment.

Changes in Risk Assessment Methods:

AFCEE is currently performing an ecological risk assessment on AOC SD-4 soil based on new USEPA risk assessment guidance.

Expected Progress Towards Meeting RAOs:

Implementation of the remedy is expected to achieve RAOs.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy/removal action?**

There is no information that calls into question of the protectiveness of the selected remedy.

**Technical Assessment Summary**

The remedy has been implemented as intended by the ROD. Additional evaluation of surface soil adjacent to the pond is being conducted and a final decision will be made in the future. There have been no changes in the physical conditions and land use of the site that would affect the protectiveness of the remedy. ARARs and TBC guidance for soil contamination cited in the ROD are being achieved. There is no information that calls into question of the protectiveness of the selected remedy.

**Table D-1** presents the technical assessment summary for AOC SD-4.

<b>Table D-1: Technical Assessment Summary for AOC SD-4</b>		
<b>Question</b>		<b>Response</b>
A	Is the remedy functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the removal action?	No

## **E. ISSUES**

The issues at SD-4 are: an ecological risk evaluation of soil adjacent to the pond at SD-4 needs to be completed, and a decision for this part of SD-4 must be documented.

## **F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

The recommendations and follow-up actions at SD-4 are: complete the ecological risk evaluation; decide on a remedy for the site, including if there exists a risk; and document the decision for the site in a future Explanation of Significant differences because the remedy in the ROD needs to be updated.

## **G. PROTECTIVENESS STATEMENT**

The selected remedy for AOC SD-4 is expected to be protective of human health and the environment upon both its completion and in the interim. Exposure pathways that could result in unacceptable risks are being controlled.

## **H. REFERENCES**

ABB Environmental Services, Inc (ABB -ES), 1992. *Comprehensive Plan for Installation Restoration Program at Massachusetts Military Reservation*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; October 1992.

ABB-ES, 1993. *Priority 2 and 3 Study Areas Site Investigation*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Portland, Maine; October 1993.

AFCEE, 2002. *Draft Ecological Evaluation of the AOC SD-4 Site*; Installation Restoration Program; Massachusetts Military Reservation; prepared by BWXT-Y12-L.L.C. for AFCEE/MMR, February 2002.

AFCEE, 1998. *Record of Decision for Areas of Contamination FTA-2/LF-2, PFSA/FS-10/FS-11, SD-2/FS-6/FS-8, SD-3/FTA-3/CY-4, and SD-5/FS-5 Source Areas*; Installation Restoration Program, Massachusetts Military Reservation; prepared for AFCEE/MMR; submitted by HAZWRAP Oakridge, Tennessee; September 1998.

AFCEE, 1997b. *Proposed Plan to Cleanup Six Areas of Contamination*; Installation Restoration Program, Massachusetts Military Reservation, November 1997.

AFCEE, 1997a. *Final Six Areas of Contamination Source Area Feasibility Study*; Installation Restoration Program; Massachusetts Military Reservation; prepared by ABB-ES for HAZWRAP; Portland, Maine; November 1997.

CDM Federal Programs Corporation, 1996. *Remedial Investigation Report for Area of Contamination SD-4*; Installation Restoration Program; Massachusetts Military Reservation; prepared for HAZWRAP; Boston, Massachusetts; April 1996.

Metcalf & Eddy, Inc., 1993. Weekly Report, Week Ending April 23, 1983; UST Removals at Site 123.

USEPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540R-01-007, June 2001.

### 9.3.35 STORM DRAIN NO. 5 NORTH & SOUTH (SD-5N, SD-5S) GROUND WATER

#### A BACKGROUND

##### A.1 Site Description

The SD-5 groundwater contamination is located at the southeast corner of the MMR. **Figure 9.3.35-1** and **Figure 9.3.35-2** presents the SD-5 groundwater contamination as of December 2002.

Groundwater contamination consists of primarily of TCE, but other contaminants are present at lower concentrations. SD-5 groundwater contamination includes a number of potential sources: tank flushing from the former Eastern and Western aquafarms, the former Non-Destructive Inspection Laboratory (NDIL) (Building 3146), the former Corrosion Control Shop (Building 3117), the Permanent Field Training Site (PFTS) (Buildings 3140 and 3144), and a fuel spill that occurred in the early 1960s (FS-5).

SD-5 groundwater contamination was divided into the SD-5North (SD-5N) plume and the SD-5South (SD-5S) plume in 1996 at the MMR boundary by the SD-5N ETR System [later renamed the Sandwich Road Treatment Facility (SRTF)].

##### A.2 Initial Responses

###### CERCLA Actions:

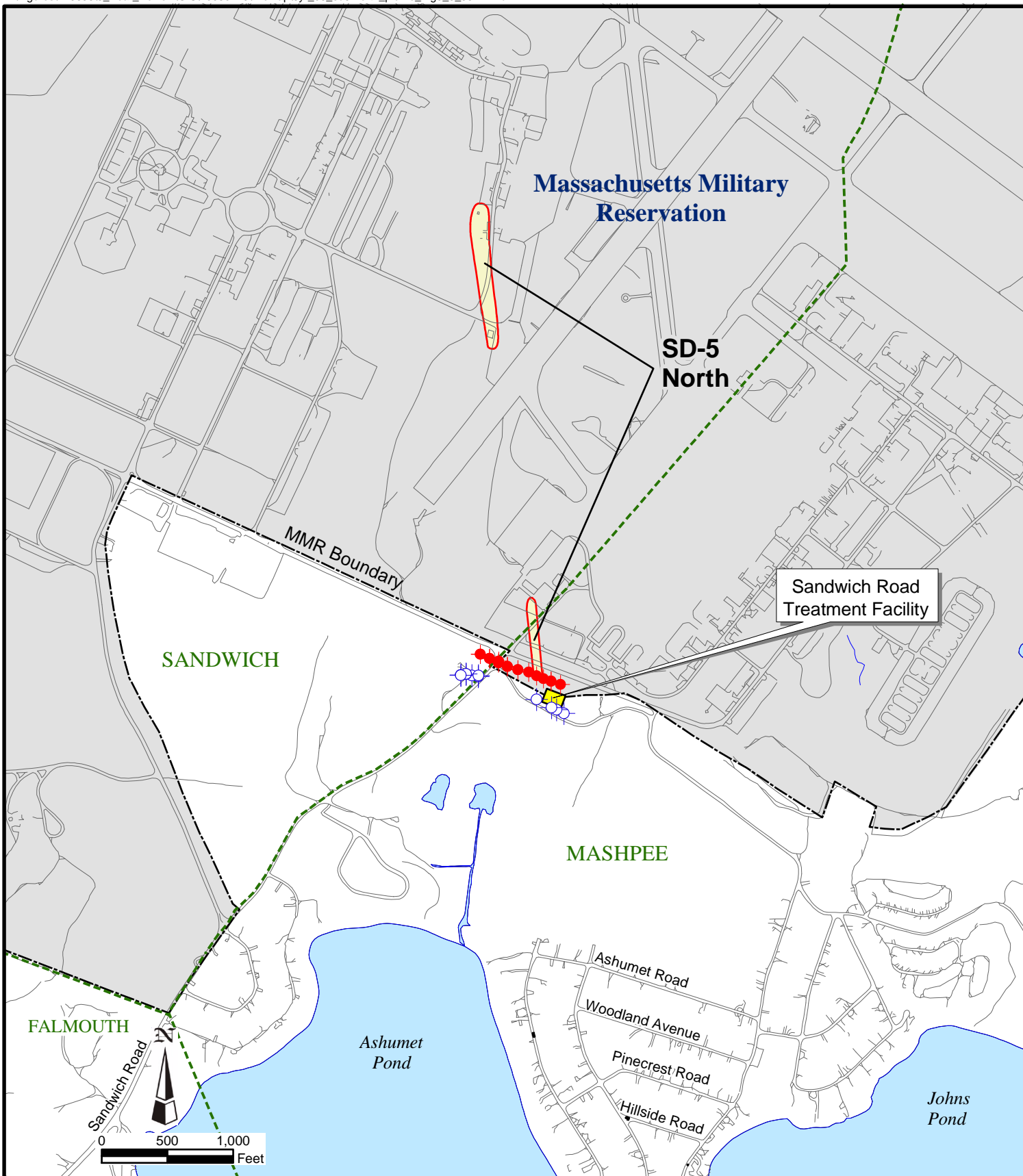
SD-5/FS-5 Source Area Remedial Action: AFCEE is excavating contaminated soil from the SD-5/FS-5. In addition, AFCEE is currently performing AS/SVE to remove chlorinated VOCs in the unsaturated zone. Refer to **Section 9.3.21** for the status of SD-5/FS-5 source area.

###### Non-CERCLA Actions:


Source Removal Actions: Several non-CERCLA source removal activities occurred in the SD-5 AOC between 1990 and 1996. In November of 1990, the ANG removed approximately 700 gallons of fluid from the NDIL leaching well, and four drainage structures at SD-5/FS-5 were removed in July 1996 as part of the MMR drainage structure removal program (DSRP). The NDIL leaching well and four other drainage structures associated with AOC SD-5 were removed during the DSRP. The NDIL building and the Corrosion Control Shop were demolished and removed in April 1994. Between October 1994 and March 1995, during the MMR tank removal program, a total of 17 underground storage tanks (UST), associated piping, and approximately 450 cubic yards of contaminated soil were removed from the Western and Eastern Aquafarms.





Engineering Controls: Workers and residents at MMR are connected to a public water supply. Residents of Mashpee and Briarwood neighborhood also have been connected to public water supply. AFCEE has offered free town water hookups to residents of towns surrounding the base in which their private well water was threatened, or potentially threatened by chemicals from the base. Since 1986, AFCEE/ANG has hooked up approximately 850 residents. Another 300 homes are scheduled in Falmouth and Bourne.

Institutional Controls: The Mashpee Board of Health adopted a moratorium on groundwater wells, which states that existing, and future residential wells located in documented or anticipated areas of groundwater contamination as defined by the Board of Health are restricted from use for any purpose (AFCEE 2002a). AFCEE also has implemented an annual residential sampling program in



# Legend

 Plume Contour = Concentrations exceeding drinking water standards or Maximum Contaminant Level (MCL). Represents an exceedance of trichloroethene (TCE) (TCE MCL = 5 µg/L)

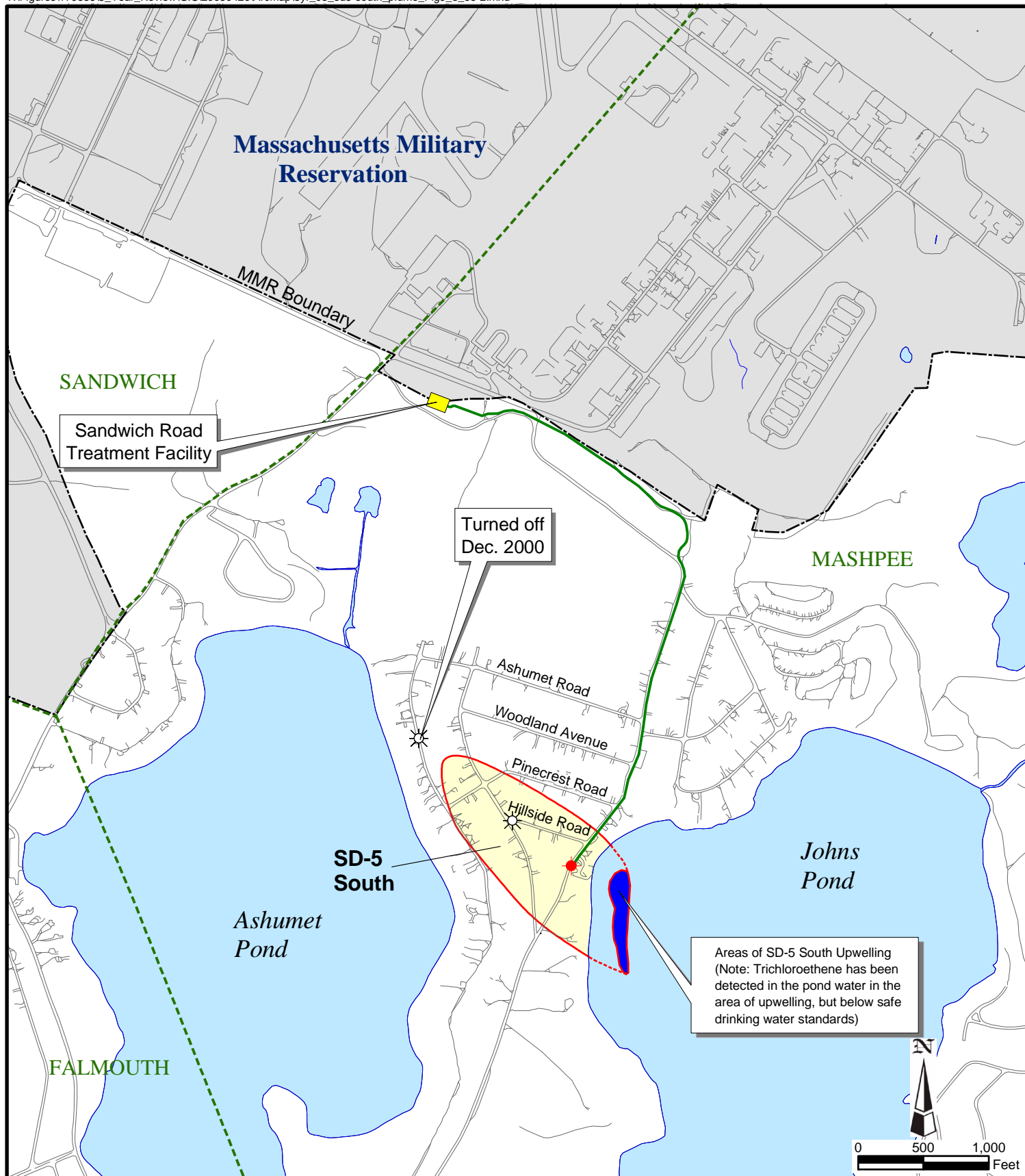
-  Treatment Facility
-  Extraction Well
-  ReInjection Well
-  Town Boundary



Air Force Center for  
Environmental Excellence

## Storm Drain 5 (SD-5 North) Plume December 2002

Massachusetts Military Reservation  
Cape Cod, Massachusetts



# **Legend**



Plume Contour = Concentrations exceeding drinking water standards or Maximum Contaminant Level (MCL). Represents an exceedance of trichloroethene (TCE) (TCE MCL = 5 µg/L)



Treatment Facility



Town Boundary



Recirculation Well



Treatment System Piping



Upwelling



Extraction Well



Air Force Center for Environmental Excellence

## **Storm Drain 5 (SD-5 South) Plume December 2002**

Massachusetts Military Reservation  
Cape Cod, Massachusetts

which AFCEE tests residential wells potentially impacted by plumes for VOCs and/or EDB. In some cases, homes are tested more frequently. For areas where AFCEE has deemed private well water is imminently threatened, bottled water is supplied.

### A.3 Basis for Taking Action

The basis for taking action is detected concentrations of chlorinated VOCs above MCLs and risk assessment results of the Southeast Region Groundwater Operable Unit (SERGOU) and the Region III study area was conducted in 1994. The baseline cancer risk calculations in the SERGOU RI indicated that unless remedial action is undertaken, future residential exposure to contaminated groundwater may present an excess lifetime cancer risk greater than the acceptable MADEP threshold of  $1 \times 10^{-5}$  and the acceptable USEPA range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ . Please note that the SD-5 Plume is one of the seven groundwater plumes included in the Interim Record of Decision (IROD) (ANG, 1995), and is currently undergoing the IROD to Final ROD process. As part of the IROD to ROD process, COCs will be identified for the final ROD. **Table A-1** presents COCs and respective cleanup levels.

<b>Table A-1 Contaminants of Concern and Respective Cleanup Levels for the SD-5 Plumes</b>			
<b>Contaminant</b>	<b>Basis</b>	<b>Conc (µg/l)</b>	<b>Standard</b>
PCE	Human Health	5	Fed MCL
TCE	Human Health	5	Fed MCL
Cis-1, 2- DCE	Human Health	5	Fed MCL
EDB	Human Health	0.02	MMCL

## B REMEDIAL ACTIONS

This section presents the regulatory actions, RAOs, and remedy descriptions for the SD-5N plume, SD-5S plume, and TCE plume.

### B.1 Regulatory Actions

1994: A Plume Response Plan was developed to contain seven groundwater plumes simultaneously. The Plume Management Process Action Team helped coordinate development of this plan. The Plume Response Plan was used as a substitute for the Feasibility Study and as a basis to develop the Proposed Plan. The NGB, DoD, USEPA, MADEP, and local communities approved the plan, resulting in an accelerated effort toward "simultaneous containment" of the following seven groundwater plumes: Ashumet Valley, CS-10, Eastern Briarwood, FS-12, LF-1, SD-5, and Western Aquafarm.

1995: The NGB and USEPA, with MADEP concurrence, signed a Record of Decision for Interim Action (known as the IROD) (ANG, 1995) for seven groundwater plumes identified at the MMR. The IROD enabled the NGB to take immediate action to protect human health and the environment, while collecting additional information to evaluate and select final cleanup alternatives.

1996: The NGB issued a 60% design report for plume containment. While the 60% design protected human health, it presented significant ecological impacts to the environment. AFCEE was brought in to manage the IRP. The Technical Review and Evaluation Team (TRET), consisting of various

technical experts, were established as an independent review committee to provide advice and recommendations. After reviewing the 60% design document, the TRET developed recommendations for next steps for each plume. Based on the TRET recommendations, AFCEE was to build a treatment system for SD-5N. As recommended by the TRET, an ETR containment system was not planned for the southern portion of the SD-5 ground-water plume.

1997: AFCEE, USEPA and MADEP introduced the DCM process, an accelerated decision-making tool to refine cleanup decisions. The DCM process was applied to the SD-5 South groundwater plume. The DCM gave the public an opportunity to review alternatives and make suggestions for final cleanup measures prior to the remedy selection. A recirculating well system was selected as the remedy to address the SD-5 plume. In December 1997, the *Storm Drain 5 South Plume Response Decision Fact Sheet* (AFCEE, 1997) was issued to document the decision to implement the remedy.

## **B.2 Remedial Action Objectives**

The objectives were defined in the IROD and DCM process and were used as the basis for determining cleanup goals.

The objectives in the IROD are described as follows:

- reduce the risks to human health associated with the potential future consumption and direct contact with groundwater and surface waters;
- protect uncontaminated groundwater and surface waters for future use by minimizing the migration of contaminants;
- reduce potential ecological risks to surface waters and through the implementation of the containment system; and,
- Restore aquifer (within confines of the SD-5 plume) to its beneficial uses with a 20 year timeframe.

## **B.3 Remedy Description**

The SD-5 groundwater plumes are being remediated via three remedial systems including: SD-5N ETR system; SD-5S recirculation well system; and the SD-5S/TCE plume extraction well system. Descriptions for these systems are provided below. Please note that these systems have been modified and are discussed in section B.4 Remedy Implementation.

### SD-5N ETR System:

SD-5N ETR system: The SD-5N ETR system commenced operation August 4, 1997. The SD-5 North ETR system consists of 10 closely spaced extraction wells, GAC, and eight reinjection wells. The extracted groundwater is processed through the SRTP. At the SRTP, the extracted groundwater is pH-adjusted with sodium hydroxide, filtered through greensand beds to remove iron, manganese, and suspended solids, and then treated using GAC filters to remove contaminants, including chlorinated VOCs and EDB. After treatment, the water is returned to the ground through a series of eight reinjection wells situated downgradient of the extraction wells along the MMR boundary.

SD-5S Axial Recirculating Well Remedial System:

SD-5S Axial Recirculating Well Remedial System: The SD-5S Axial Recirculating Well Remedial system began operation in June 1999. The SD-5S Axial Recirculating Well Remedial System consists of two recirculating wells located axially in the southern portion of the SD-5S plume on Highland and Wheeler roads between Ashumet Pond and Johns Pond. Water treatment consists of air stripping influent water within the wellhead vault, followed by filtration of the air stream by primary and secondary activated carbon units. Treatment systems are housed in below-grade vaults installed at each recirculating well location. The design extraction and reinjection rates are 60 gpm for each recirculating well.

SD-5S Hooppole Road/TCE Plume (part of the CS-10 leading edge plume ) Extraction Well System:

This remedial system consists of two extraction wells, about 6,000 linear feet of pipeline, and a connection into the piping system within the SRTF. The southern well is located to intercept the TCE plume and stop the discharge of TCE into Johns Pond. The northern well is located to intercept the SD-5S plume along Hooppole Road for additional mass removal. The extraction wells are each approximately 150 feet deep. Each well is located within an underground vault located along Hooppole Road in the Town of Mashpee. The TCE plume well has an extraction rate of approximately 75 gpm; the SD-5S plume well has an extraction rate of approximately 100 gpm. After treatment, the additional treated water is distributed evenly among the eight SD-5N reinjection wells and the six CS-10 reinjection wells that are currently in operation.

**B.4 Remedy Implementation**

Provided below are interim remedies that address the SD-5 groundwater contamination.

Groundwater Treatment Systems:

- SD-5N ETR System: The SD-5 North remedial system startup date was August 4, 1997. The ETR system has removed approximately 4.5 lbs of contaminants since startup through December 2001 (AFCEE, 2002b). TCE concentrations in the SD-5N source area monitoring wells have decreased significantly from historical concentrations that ranged up to 250 µg/L in 1996 to a maximum concentration of 10 µg/L in November 2001 (AFCEE, 2002b). In March 1999, two extraction wells, which flank the SD-5N fence, were shut down because they were not extracting components (AFCEE, 2002c). Between March 2000 and July 2001, seven of the remaining wells were taken offline because these wells were no longer removing groundwater with contaminant concentrations exceeding MCLs.
- SD-5 South Recirculation Well System: The SD-5 South axial system began operation on June 17, 1999. The recirculation well system has removed approximately 4.62 lbs of contaminants since startup through December 2001 (AFCEE, 2002b). One of the recirculating wells is no longer removing any contamination from the aquifer and has been shut down (AFCEE, 2002c). Contaminant concentrations in monitoring wells located within the current SD-5S plume boundary continue to decrease. Only TCE has been detected at

concentrations that exceed the MCL. EDB concentrations in the SD-5S plume have not exceeded the MMCL since February 2001 (AFCEE, 2002b).

- SD-5S Hooppole Road/TCE Plume Road Extraction Well System: The TCE/SD-5S remedial system: TCE discharging to Johns Pond prompted a time-critical removal action in 1999. The TCE/SD-5S remedial system began operation on January, 22 2000. Purpose of this remedial system was to intercept the TCE plume and stop the discharge of TCE into Johns Pond. In May 2001, the flow rate for the SD-5 extraction well was increased. The extraction well system has removed 64.8 lbs of TCE since startup through December 2001 (AFCEE, 2002b).

### C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The following activities were conducted/observed since the last review based on information presented in the

- SD-5 South Axial system: Startup on June 17, 1999.
- SD-5 South/TCE Plume system: Startup on January 22, 2000.
- SD-5 Interim Remedial Action Report: Completed in June 2001. (AFCEE, 2001)

### D. TECHNICAL ASSESSMENT

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA 2001). **Table D-1** summarizes the technical assessment.

#### Question A: Is the remedy functioning as intended by the decision documents?

Yes, the interim remedy is functioning as intended by the IROD and SD-5 South Plume Response Decision Factsheets. AFCEE is currently completing the IROD to ROD process, which may alter the interim remedy based on results of current groundwater monitoring data and system remedial performance data, as well as conclusions of risk assessments using current data. System performance monitoring results provided below were obtained from the *Storm Drain-5 and Chemical Spill-10 Semiannual System Performance and Ecological Impact Monitoring Report July-December 2001* (AFCEE, 2002b) and the *Final Combined Storm Drain –5 and Chemical Spill-10 2001 Annual Performance and Ecological Impact Monitoring Report* (AFCEE, 2002c).

#### SD-5N System Performance Monitoring Results

Since the beginning of system operation, the mass and volume of the SD-5N plume have diminished. Remnants of the SD-5N plume still exist in the SD-5N source area and within the capture zone of extraction well 28EW0004, the only operating extraction well in the SD-5N system. Although TCE concentrations exceed the MCL in the source area, transport modeling results indicate that no contamination at concentrations exceeding the MCL will reach the SD-5 North extraction well fence. The system has achieved the primary design objective of plume containment at the MMR base boundary. Based on the results of the performance monitoring program, the SD-5 plume boundary has been revised and the SD-5 treatment systems have been optimized.

SD-5S Recirculating System Performance Monitoring Results

The mass and volume of the SD-5S plume have also decreased significantly since system start-up. TCE is currently detected at concentrations exceeding the MCL in four monitoring wells in the SD-5S plume with a maximum detected concentration of 34 µg/L in well 28MW0035B. Groundwater modeling results also indicate that the remaining TCE contamination in the SD-5S plume will fall below the MCL within five years after the May 2001 increase in flow rates at extraction well 28EW0015.

SD-5S Hooppole Road/TCE Plume Extraction Well System Performance Monitoring Results

The mass and volume of the SD-5/TCE Plume Hooppole Road plume has remained consistent. However, the system, which has been in operation only since January 2000, has removed 64.8 lbs of TCE.

Institutional/engineering controls that prohibit the use of contaminated groundwater that are in place have mitigated exposure pathways to humans.

**Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**

Changes in Standards and To-Be Considered

There have been no changes in standards or TBC guidance.

Changes in Exposure Pathways

There have been no changes to exposure pathways and land use of the site that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for COCs.

Changes in Risk Assessment Methods:

There were no changes in risk assessment methodology.

Expected Progress Towards Meeting RAOS:

Treatment and capture of SD-5 plume contaminants by remedial systems have reduced or prevented the continued migration of these contaminants. The SD-5 North ETR system has been operational since 1997 and has contained the SD-5 North plume at the base boundary. The historical SD-5 North plume (basis of design) has diminished due to operation of the SD-5 North remedial system and attenuation processes. Although concentrations that exceed MCLs persist in the SD-5 North source area, transport modeling results indicate that no contamination reaches the SD-5 North extraction well fence at concentrations exceeding the MCL.

The SD-5 North ETR system also has effectively cut off the source of the SD-5 S plume. Remedial systems in the SD-5 S plume, including recirculating wells and an extraction well have also significantly reduced the continued migration of the SD-5S plume by capturing a significant portion of the mass. The trailing edge of the SD-5S plume is currently delineated downgradient of the northernmost recirculating well. Groundwater modeling results indicate that approximately 85 percent of the remaining SD-5 South plume mass will be captured within five years (AFCEE 2002c). The remaining mass, which is downgradient or crossgradient of 28EW0015, discharges into Johns Pond and is diluted upon interaction with the surface water.

Institutional/engineering controls that prohibit the use of contaminated groundwater that are in place have mitigated exposure pathways to humans.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy?**

No.

<b>Table D-1: Technical Assessment Summary for the SD-5 North and SD-5 South Plumes</b>		
<b>Question Item</b>	<b>Question</b>	<b>Response</b>
A	Is the removal action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the remedy?	No

**E. ISSUES**

The issue at SD-5 North & SD-5 South groundwater plume is: a final remedy needs to be selected and documented in a final ROD.

**F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

The recommendations and follow-up actions area: a final remedy should be selected and documented in a final ROD. This process is underway with the issuance of the IROD to ROD workplan of which at SD-5 North and South groundwater plume is a part. In addition, SD-5 groundwater treatment systems operations including monitoring should continue until RAOs have been achieved.

**G. PROTECTIVENESS STATEMENT**

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled by the operation of the SD-5 treatment systems and institutional/engineering controls that prohibit the use of contaminated groundwater.

All threats at the site have been addressed by the implementation of the remedy (i.e., operation of the SD-5 treatment systems) Furthermore, institutional/engineering controls are in place that prohibits the use of contaminated groundwater).

Long-term protectiveness of the remedial action will be verified by results of groundwater monitoring and system remedial performance monitoring. Current monitoring data indicate that the remedy is functioning as required to achieve groundwater cleanup goals.

## H. REFERENCES

AFCEE, 1997 *Storm Drain 5 South Plume Response Decision Fact Sheet*. Prepared by AFCEE, Installation Restoration Program, Otis ANG Base, MA December 1997

AFCEE, 2002a. *Final Storm –5 Interim Remedial Action Report*. Prepared by AFCEE/MMR, Installation Restoration Program, Otis ANG Base, MA. June 2001

AFCEE, 2002b. *Storm Drain-5 and Chemical Spill-10 Semiannual System Performance and Ecological Impact Monitoring Report July –December 2001* . Prepared by Jacobs Engineering for AFCEE/MMR, Installation Restoration Program, Otis ANG Base, MA. April, 2002

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### 9.3.36 WESTERN AQUAFARM GROUND WATER

#### A BACKGROUND

##### A.1 Site Description

The Western Aquafarm area was identified as a potential source of contamination during a 1986 expanded records search (ANG 1986). The Western Aquafarm consisted of six 25,000-gallon USTs that were used in the 1950s and 1960s to store and transfer AVGAS and JP-4. Fuel was transferred from the tanks by pumping water in the tanks to displace the fuel. To refill the tanks with fuel, the water was displaced and was discharged into a 1-acre basin within the Central Drainage Swale.

The initial profile of the Western Aquafarm plume was based on the SERGOU RI which was completed in 1994 (ABB, 1994). The SERGOU also includes the Eastern Briarwood plume and the SD-5 plume. Groundwater COCs in the Western Aquafarm plume consisted of fuel-related compounds. At the time of the Plume Response Plan (OpTech, 1994), the Western Aquafarm Plume was approximately 1,550 feet long, approximately 825 feet wide, and 40 to 60 feet thick.

##### A.2 Initial Responses

###### Non CERCLA Actions:

AFCEE has addressed a potential source area by performing tank removal activities at the Western Tankfarm. Six USTs and associated piping were removed in October 1994 (ANG, 1995a).

###### CERCLA Actions:

AFCEE is currently performing biosparging at FTA2/LF-2 AOC. Refer to Section 9.3.30 for current status of FTA2/LF-2. AFCEE is also conducting excavation and offsite disposal of contaminated soil at SD-5 source. Refer to Section 9.3.20 for the current status of SD-5 source.

##### A.3 Basis for Taking Action

The basis for taking action for groundwater were the site characterization and risk assessment results of the SERGOU RI completed in 1994 (ANG 1994). A ethylbenzene plume was delineated from the Western Aquafarm to the base boundary. Please note that the Western Aquafarm area is one of the seven groundwater plumes included in the Interim Record of Decision (IROD) (ANG, 1995), and is currently undergoing the IROD to Final ROD process. As part of the IROD to ROD process, COCs will be identified for the final ROD. **Table A-1** presents COCs and respective cleanup levels.

<b>Table A -1 Interim Action Contaminants of Concern and Respective Cleanup Levels for the Western Aquafarm Plume</b>			
<b>Contaminant</b>	<b>Basis</b>	<b>Conc (µg/l)</b>	<b>Standard</b>
Ethylbenzene	Human Health	700	Fed MCL

#### B. REMEDIAL ACTIONS

This section presents the regulatory actions, remedial action objectives (RAOs), and remedy description for the Western Aquafarm Plume.

## **B.1 Regulatory Actions**

As documented in the Final Record of Decision for Interim Action Containment of Seven Groundwater Plumes (ANG 1995b) (also known as the IROD), the interim remedy is designed to intercept the seven contaminated groundwater plumes (i.e., LF-1, SD-5, Western Aquafarm, Eastern Briarwood, FS-12, CS-10, and Ashumet Valley) to prevent further migration of contaminants above MCLs and non-zero MCLGs (ANG 1995b).

The conceptual model for the interim response action for the Western Aquafarm plume included an ETI system. After the TRET evaluated the 60-percent design submittal, it was determined that this remedy could not be implemented without a detrimental impact to the sensitive ecosystems, undesirable alterations in regional groundwater flow paths, and counterproductive spreading of the contamination. AFCEE issued the Strategic Plan (AFCEE, 1997), which presented a revised approach that included LTM to ensure that no unacceptable toxicological risks develop.

## **B.2 Remedial Action Objectives**

The objectives were defined in the IROD (ANG, 1995) were used as the basis for determining cleanup goals.

The objectives in the IROD are described as follows:

- reduce the risks to human health associated with the potential future consumption and direct contact with groundwater and surface waters;
- protect uncontaminated groundwater and surface waters for future use by minimizing the migration of contaminants;
- reduce potential ecological risks to surface waters and through the implementation of the containment system; and,
- Restore aquifers to beneficial uses.

## **B.3 Remedy Description**

The interim remedy consists of a LTM program. The interim remedy was developed in response to the TRET evaluation of the 60% design of the ETI system proposed in the IROD. The LTM program was presented in the Strategic Plan (AFCEE, 1997).

## **B.4 Remedy Implementation**

In 1996, a LTM program for the Western Aquafarm plume was initiated to assess contaminant trends and distributions. In addition, surface water and sediment samples would be collected from West Pond, which may be impacted by groundwater from the Western Aquafarm. The LTM program for Western Aquafarm area is currently ongoing and is in its sixth year of performance. The program initially included quarterly sampling of monitoring wells in the area. The frequency has been reduced to semiannually (AFCEE, 2002a). In the fifth year of the monitoring program, all ethylbenzene concentrations were below the MCL, thus eliminating the Western Aquafarm area plume. VOCs or EDB were not detected in samples collected from West pond and associated bog

systems as part of an Ecological Studies report (AFCEE, 1998). Currently, samples are not collected from the West pond and associated bog systems. The reduction of the Western Aquafarm plume over the past five years of this monitoring program was attributed to natural attenuation processes, including adsorption, diffusion, dispersion, and dilution, occurring within the plume.

### **C. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW**

The following activities were conducted/observed since the last review based on information presented in the

- LTM of groundwater: Began in 1996. Concentrations of ethylbenzene are currently below the MCL.
- IROD to ROD Workplan: Completed in October, 2002. (AFCEE, 2002c)

### **D. TECHNICAL ASSESSMENT**

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. AFCEE performed the technical assessment based on USEPA guidance provided in section 4.0 of the Comprehensive Five-Year Review Guidance (USEPA 2001). **Table D-1** summarizes the answers to the technical assessment questions.

#### **Question A: Is the remedy functioning as intended by the decision documents?**

Yes, the interim remedy (LTM) is functioning as intended by the Strategic Plan (AFCEE, 1997). Natural attenuation of fuel-related VOCs appears to be occurring based on LTM program results. Ethylbenzene has not been detected above the MCL since September 2001 (AFCEE, 2002b and AFCEE 2002c). An ethylbenzene plume boundary is no longer mapped. Furthermore, West Pond and associated bog systems are not impacted by the Western Aquafarm area.

AFCEE is currently completing the IROD to ROD process, which may alter the interim remedy based on results of current groundwater and surface water monitoring data as well as conclusions of risk assessments.

#### **Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**

##### Changes in Standards and To-Be Considered

None

##### Changes in Exposure Pathways

There have been no changes to exposure pathways and land use of the site that would affect the protectiveness of the remedy.

##### Changes in Toxicity and Other Contaminant Characteristics

There have been no changes in the toxicity factors for COCs.

Changes in Risk Assessment Methods:

There were no changes in risk assessment methodology.

Expected Progress Towards Meeting RAOS:

Natural attenuation of fuel- related VOCs appears to be occurring based on LTM program results. Ethylbenzene has not been detected above the MCL since September 2001 (AFCEE, 2002b and AFCEE 2002c). An ethylbenzene plume boundary is no longer mapped.

**Question C: Has any other information come into light that could call into question the protectiveness of the remedy?**

No.

<b>Table D-1: Technical Assessment Summary for the Western Aquafarm Area</b>		
<b>Question Item</b>	<b>Question</b>	<b>Response</b>
A	Is the removal action functioning as intended by the decision documents?	Yes
B	Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the removal action selection are still valid?	Yes
C	Has information come to light that calls into question the protectiveness of the remedy?	No

**E. ISSUES**

The issue for the Western Aquafarm groundwater is: a final remedy needs to be selected and documented in the final ROD.

**F. RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

The recommendations and follow-up actions are: a final remedy should be selected and documented in a final ROD. This process is underway with the issuance of the IROD to ROD workplan of which the Western Aquafarm groundwater is a part. In addition, Western Aquafarm monitoring should continue until a final decision is made.

**G. PROTECTIVENESS STATEMENT**

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals. Based on recent LTM results, concentrations are below cleanup levels in groundwater. All threats at the site have been addressed by the implementation of the remedy.

Long-term protectiveness of the LTM will be verified by results of groundwater monitoring. Current monitoring data indicate natural attenuation processes are achieving cleanup goals of restoration of groundwater to beneficial uses.

## H. REFERENCES

AFCEE, 2002c *Final Work Plan for the Process Leading to Final Groundwater Decisions for Eastern Briarwood, Western Aquafarm, Storm-Drain-5, and Fuel Spill-12* Prepared by Jacobs Engineering Group Inc. for AFCEE/MMR Installation Restoration Program, Otis Air National Guard Base, MA. October 2002

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